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TEACHER EDUCATION AND THE NEW MEDIA.
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PROGRAMS OF TEACHER EDUCATION IN THE UNITED STATES WERE DESCRIBED, AND THE CONTRIBUTION OF NEW MEDIA TO THESE PROGRAMS WAS ANALYZED. VARIOUS FACETS OF A TEACHER'S FUNCTION WERE DISCUSSED IN TERMS OF DESIRED COMPETENCIES AND CHARACTERISTICS. THESE FACETS WERE THEN ASSESSED IN RELATION TO TEACHER EDUCATION PROGRAMS USING NEW MEDIA AS AN AID TO INSTRUCTION. THE FINDINGS INDICATE THAT EXPECTATIONS FOR NEW MEDIA IN TEACHER EDUCATION HAVE EITHER NOT BEEN VERIFIED THROUGH RESEARCH AND EXPERIMENTATION OR HAVE NOT YET HAD SUFFICIENT STUDY FOR PROPER CONCLUSIONS AND APPLICATIONS TO BE DRAWN. IT WAS ALSO NOTED THAT MOST FUNCTIONS OF NEW MEDIA WHICH ARE LARGELY OPERATIONAL IN CHARACTER AND THEREFORE CAPABLE OF THE GREATEST IMMEDIATE EFFECT ON THE PROCESS OF TEACHER EDUCATION REMAIN, FOR THE MOST PART, UNPROVED WITH REGARD TO EFFECTIVENESS FOR TEACHER TRAINING. (GD)

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TEACHER EDUCATION
and the
NEW MEDIA

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PART I. BACKGROUND

Capter 1. Trends in Teacher Education

Programs for the educatin of teachers follow many patterns. Institutional preferences, State and local certification requirements, and degree of school system involvement - all contribut to variations in concept, length, and nature of the various teacher training programs. Even the relationship of teacher supply and demand has an impact, particularly in period of short supply, when "crash" programs abouhd, substandard emergency certificates are issued, and teacher training programs lose coherency. Some States now require 5 years of education beyond the secondary school for both elementary and secondary school teachers; others require 5 for secondary and only 4 for elementary; others are satisfied with 4 for both. Some teacher training institutions prefer to spread those studies and activities that are labelled "professional" by proponents, and "Narrowly vocational" by their deriders, over the major portion of the teaching student's post-secondary school education. Other favor the concentration of the professional training program into a single year, preferably after the baccalaureate and in connection with a concurrent teaching assignment.

The content itself is subject to many variations, particularly in the balance and relationship, if any, between the studies called "liberal" and those, for want of a better, noncontroversial term, called pedagogical. Even within the latter realm, where one might expect greater agreement because of necessary functional orientation of any professional training program, widespread variation exists, particulary in the balance and relationship between studies and activities that are conceived of as largely foundational and theoretical and those that have primarily an applied, functional orientation.

The relationship of universities and school systems in training programs varies in a continuum between close partnership and uncommunicative aloofness. Some universities run their own schools as campus demonstration and training centers; some share control of such schools with the local school system; others prefer to utilize the schools of a given system on a guest basis, without exercising control; while still others utilize a combination of these plans. Among school systems, particularly the larger and wealthier ones, some prefer their own inservice training program; others depend on universities for inservice upgrading of their staffs; many utilize a combination of the two; and most provide salary and status incentives for further study. Variation in community wealth affects teacher education programs. Wealthier communities usually require larger and more advanced training.

The teaching profession is unique, therefore, in that no agreement on a standard pattern or on a controlled variation of patterns for teacher education has been reached such as exists for the medical, legal, or even social or religious professions.

In view of this diversity, the task becomes one of looking first not at the means means - the programs themselves - but at the results - the competencies and characteristics of a functioning teacher. What is proposed, therefore, is to follow the process used in evaluating teacher education programs and to consider the contribution of new media to these programs, as well as the degree to which they may contribute to the realization of competencies and characteristics desired in a functioning teacher. There follows, then, an attempt to analyze various facets of a teacher's function; to describe them in terms of desired competencies and characteristics; to consider them in relation to training; and finally to assess the contributions of new media to this training.

Nature of the Teaching Function

Teaching is a social function, its aim being to guide desirable growth in others. It is, therefore, a social or interacting relationship between people - the guiding and the guided, the teaching and the taught.* 1/ Its method is communication - the transmission of signals from teacher to learner and from learner to learner. A school is an organized community of learners and teachers, ordered so as to facilitate this communication. For economic reasons, this organization must enable few teachers to serve many students.

1/ An interesting contrast in point of view of elementary and secondary teaching is the corresponding terminology used ihnhigher education: A professor teaches courses (which are organizations of subject matter), not classes (which are organizations of students); what he teaches, therefore, is thought to be of primary importance, while whom he teaches is secondary.

Teaching and Desired Ends

The goal to be attained will influence the teaching method. Student appraisal, stimulation or arousal of interest, presentation of new knowledge, development of skills, drill in recently acquired competencies, and review - all make distinctuve demands on the type of teacher and student activity required. The complementary teaching arts of questioning, telling, and demonstrating can be used in various ways and in many combinations to achieve these purposes, as well as student activity including listening, observing, reading, answering, discussing, reporting, writing, manipulating, alone and in comination, in response to teacher stimulation. For example, the old-fashioned formal recitation is essentially a device for student appraisal - questions are asked in order to assess the state of the student's knowledge, the quality of homework and mastery of outside assignments usually not covered in classroom discussions. The omnipresent university lecture, on the other hand, is essentially a method of imparting information by professors; classrooms may be wired for sound, or, in their most recent manifestation, lectures may be transmitted via television, to listening and note-taking students.

These two modes of teaching, the former onece characteristic of almost all primary and secondary schooling and the latter still predominantly characteristic of higher education, are but two of many competencies now expected of trained professional. When executed correctly, the questioning will accurately assess student attainment, and the lecture will provide a stimulating, well-orgainized presentation of new subject matter. When done poorly, the questioning will have to be buttressed by disciplinary devices to maintain order, and will provide little else than an hour of forced and possibly wasted external attetnion, with the lecture exercising a soporific effect on the passive and an outlet in artistic doodling or day dreaming on the more creative students. Skillful questioning can go far beyand mere formal student appraisal, while the lecture can do more than present information. Questions can stimulate, challenge, develop student ability to analyze, appraise, generalize, remember, build on previous knowledge, and recognize the student's own limitations. And most effectively, they can lead him to ask his own questions and avoid depending exclusively on the instructor.

A University lecturer can enrich - by stimulation, clarification, and demonstration - the resources of the library which usually contains information upon which the lectures are based. Twin techniques of questioning and telling can, therefore, be utilized in various ways to achieve various ends, except that, in the former instances, emphasis is primarily on immediate student response, while in the latter case, emphasis is more on activity by the teller. In the former situation students are required to react and perform as individuals; in the latter they approximate a mass audience. In both, however, the teacher is overtly dominant; the lines of communication have their primary source in the teacher and, in the telling technique, run from teacher to students and, in the questioning technique, from teacher to individual student and back.

Some purposes, however, suggest approaches for which the foregoing are not adequate. For example, if a sharing of student views, i.e., an interplay of minds on analysis of a common problem, is desired, some learning activity is required that will bring to the fore lines of communication among students, as in a discussion, with the leader (either student or teacher) guiding without dominating. If successful, such an organization of learning activity promotes both individual and social ends, the individual being a participating member of a learning community. If improperly guided, it can degenerate into an aimless, frustrating sharing of ignorance. The role of a teacher in this type of learning organization is quite different from the recitation or the lecture. His function is to guide without overt domination, making his presense felt only when necessary to further the discussion, acting as a resource when uncertainty as to facts develops, refereeing strong differences of opinion, and stimulating waning interest in the subject.

Teaching and the Nature of Skills and Subject Matter

Teaching and the Nature of Skills and Subject Matter

Another way of viewing factors determining the teaching function is to consider the skills and knowledge to be acquired. An example from the teaching of a second language, and one from teaching an experimental science, will illustrate both distinctive and common factors inherent in acquisition of the subjects themselves that will determine the most effective teaching method. Oral competence in a language involves the habitual, almost immediate translation of thought into speech. A fluent speaker of his native language is at a minimum loss for words because the transference of thought to verbal symbols takes place as a matter of habit. He can concentrate largely on his ideas; however, the student of a second language needs to think about words and grammar also. In addition, the native language stands between thought and translation into a foreign tongue.

A parimary function of a language teacher, then, is to provide, stimulate, and direct exercises that will gradually cause speech patterns in the learner to become habitual. Imitation, repetition and controlled variation, are necessary characteristics of such drills. Little by little, if successful, they will enlarge the student's store of automatic response patterns until finally he will be able to "think" to some useful degree in the second language, and will place minimum dependence on the intermediary response-delaying crutch of his native tongue. To be sure, analysis of specific language structures will be necessary; certain rules of the game can be learned usefully, but these are intermediary way-stations to the primary task of developing habits of language response. Logical analysis may provide one basis of understanding for certain (but by no means all) aspects of language usage, but in the final result, the act of speaking and responding, they have no functional place. The teacher of language, therefore, has responsibilities in the ordering of learning activities that derive directly from the nature of language itself. With the acquisition by his students of a store of instantly available language patterns and responses (a primary goal), he must provide, and check repetition and response drills with due regard to attention and interest, limits and to fatigue.

In contrast, a teacher of a laboratory science is faced with another set of imperatives. Science is concerned with understanding and manipulating the physical world. Its method is analytical and experimental, always seeking the unknown. It is preeminently the discipline of discovery. A teacher of science, then, must order his learning activities in such a way that they properly embody the nature of the subject itself and the imperatives that govern its learning and further development. He will rely on things that can be seen and manipulated; demonstrate with carefully prepared appratus and material; and provide opportunities for experimentation by students. He will set great store by activities that will enable the student, at his own level, to experience the challenge and satisfactions of scientific discovery, through so-called open-ended experiments in which the result is not known by the student beforehand. He must not only teach the facts of science but must also provide opportunities for the student to experience the method of science. Thus his mode of teaching may be quite difference from the teaching of language or, for that matter, from the teaching of poetry, history, music, art - each of which imposes its own imperatives upon those whose responsibility it is to guide learning.

Teaching and Nature of the Student

The differing developmental stages in a student present differences in such critical factors as attention span, relation to peers and adults, motivations, interests, life habits, background in experience, learning skills, and personality needs that will inevitably affect the teaching function. But within each group at a comparable developmental state, (12-year olds, for example) the range of individual differences may also be significantly wide, and may include intelligence, interests, state of maturity, personality, home environment, and social relations. On the other hand, a 12-year old group organized according to relative homogeneity in scholastic ability, will present its own unique teaching requirements. A coeducational group also presents different conditions from one composed of either boys or girls only; younsters from middle-class families have significantly different requirements than do those from low socioeconomic groups. The life-style characteristic of homes in which they are being reared and the neighborhoods in which they play, exert their influence. The social dynamics of any given classroom community - friendships, enmities, degree and kind of intercommunication among individuals, cliques - all may affect the direction and organization of learning activity.

Each group and each individual within each group in some way presents unique social conditions that will inevitably affect the organization and conduct of instruction. It is the responsibility of the teacher to instruct so as to meet most closely the peculiar needs of each member and each group.

Teaching and the Teacher

Whether effective or ineffective, the instructor plays a major role as a determinant in student growth and development, often influencing much more than scholastic progress.

The question as to the type of person who would make a good teacher is difficult to answer. Certainly no single prototype can or should be suggested by whose mold all teachers are to be judged. One can agree, however, on certain personal characteristics that can be inimical to one particular instructor, and certain traits that are favorable to effective functioning in any educator. A teacher, performing in a position of leadership and guidance, must gain respect and acceptance from the student, and must be able to establish an empathic relationship, sufficiently based on mutual acceptance of one another's roles, to permit positive working relationships. A person who find himself, for whatever reason, uncomfortable, unhappy, resentful, hostile, inadequate, or fearful in the company of students should not remain in teaching since such apparent inadequacies might cast an unwholesome and negative influence on his attempts at teaching.

Teachers need not be reverenced by all their students, but they must be accepted as mentors; their directions must be received with a sufficient degree of willing acceptance or even occasional enthusiasm, rather than with reluntance, opposition, or defiance. The effective teacher likes his work, is contented in the company of his students, is an accepted and positive leader in a learning community - his classroom - and is respected, liked, or idealized by most of his students. He motivates and directs a large number of his students to a point where they can be said to have achieved significant and measurable behavioral and scholastic performance goals.

On the other hand, the acceptable range of positive characteristics is wide, both in kind and degree. Teachers should differ; teaching styles should be varied. Some teachers are at their best in situations of relative intimacy - a discussion group, for example - in which their leadership is manifested in unobstrusive comments, selective supporting statements, and occasional helpful questions, and in which their presence and direction are felt but are projected only when advisable. Others are at their best in more overt ways, tending to exercise greater dominance over a group. They perform more, tell more, directing attention to themselves rather than to the group. Both may be excellent teachers, but they will achieve their effects in different ways. The atmosphere in one class may be lively, relatively noisy, punctuated with laughter; another may be quiet, reflective, sober, with, usually, only one voice being heard at a time. While such differences may result from the type of scheduled learning activity, the subject under consideration, goals of the lesson, and/or composition and social dynamics of the student group, they also can reflect the instructor's personality or teaching style - most importantly resulting from his competence as a teacher and in turn the product of interaction of experience, training, and innate personal qualities.

Teaching and Its Professional Environment

The old saw about Mark Hopkins, his student, and a log assumes that the people involved are far more important than their teaching and learning environment. Undoubtedly this is true, yet even in this simplest of teaching organizations, the environment must be considered. The log restricts class size; its concave shape and unyielding surface render its use for any length of time impossible, if only, because of discomfort and without regard to weather or other conditions. Learning exchanges in this environment would be largely verbal. When Socrates taught the Pythagorean theorem to an illiterate slave, he diagramed linear illustrations with a stick in the sand.

Environment (as a resource or limitation) exercises an inevitable effect on the function of teaching and the way teaching-learning processes develop. A classroom with fixed seats, all facing the instructor, favors the type of teaching in which the instructor is the focus of attention, but it inhibits group discussions, person-to-person exchanges, small group work projects, or any activity in which students should face each other and have a working area larger and more flexible than the traditional school desk. The teacher who desires to organize learning activities for which fixed seats were not designed must find ingenious ways to overcome physical limitation. In rooms with movable equipment, on the other hand, the problem is one of arrangement, with a price in time and commotion.

Ideally, the environment and resources for teaching should be continually adjustable to the requirements of the teaching-learning situation. Realistically the converse is more often true - the organization of teaching and learning activities is dependent on the environment and resources available. To be sure, a more flexibly organized environment, like that available in some modern school buildings designed for flexible use, allows more scope to the differentiation of teaching-learning activities; but inevitably, adaptation and adjustment to what is available, is a major responsibility of the teacher. This is true with respect not only to the design and furnishings of the schoolroom itself - the size, number, and kind of chalkboards and display boards; its lighting, ventilation, and ambient noise level - but also to the equipment - projectors, recorders, maps, globes, models, - supplies and books that can be made available for use, and to the supportive services normally associated with these aids. The teacher of science with only one demonstration-laboratory table available operates under significantly different teaching conditions than the one who has a laboratory station for every student. The availability of only one microscope creates a different condition for teaching than the availability of a dozen, or of a microprojector.

Other determinants of teaching practices involve school scheduling: the organization of the day into time periods; the scheduling of classes; the organization of instruction on a departmentalized or self-contained classroom basis, or on the graded or upgraded system; and others. A teacher having responsiblity for teaching 5 classes of 35 students each, meeting each in 5 separate 45-minute daily instructional segments each week, must order his instruction quite differently from the teacher who meets the same class of 35 each day for the major part of the school day. Courses organized in 80-minute period segments provide a different possibility of instructional choices than those operating on 40-minute units. Those meeting once a week present different problems from those meeting three or five times a week.

The teaching environment extends beyond the school to the accessible community. A school located within visiting range of a stock or commodity exchange, can provide direct experience, while the more remotely situated school must produce vicarious substitutes. Each community, however, will have some advantages, material and human, which can usefully supplement resources of the school. Awareness of their availability should be part of a teacher's equipment.

Finally, the teaching environment is subject to a set of significant human factors, both within and outside of the school. The relationship of teacher to colleagues, supervisors, parents, and community forces concerned with the school will affect the nature of his teaching. Parent and community expectations, some supportive and some critical, must be met, judged, honored, or resisted, as legitimate professional principles and standards dictate.

Competencies Required in a Teacher

The nature of the teaching function necessitates development of many teacher competencies, which in turn determine the imperatives for teacher education.

Viewed as the fulfillment of pedagogic goals, teaching must have recognized purposes, partially, at least, of the teacher's choosing. He must fashion and guide learning activities appropriate to those purposes, and evaluate the degree of their fulfillment. Whatever prescriptions and expectations may be embodied in syllabi, standard examinations, and supervisory directives, they must be known and mastered; and the range of teacher choice (significantly wide in even the most prescriptive of school situations) must be determined and proper teaching plans made and carried out. The translation of goals into enabling learning behavior is by no means simple or easy, particularly if the degree of fulfillment is under continuing evaluation. A sound command of the range of means possible for reaching desired ends, is required as well as the ability to choose among them, carry them out, and assess their success. Skill is required in the proper refinement of long-term goals into more immediate subgoals, attainable within each given instructional unit.

An understanding of the processes of democracy embodied in a forthcoming presidential election may well be assisted by the practice of electing class officers. The establishment by the class of a mythical investment program with day-by-day analysis of the consequences of class decisions to "buy" and "sell" current securities may well culminate in a full-scale study of the nature and control of corporations. An evaluation of the results of an examination consisting of verbal problems in algebra may reveal the need for a thorough review of the process of solving quadratic equations.

A teacher must be able to recognize the consequences of his goal-centered teaching behavior, and be a versatile and effective master of at his disposal.

Teaching, viewed from the point of view of subject matter or the nature of knowledge is to be imparted and skills to be taught, suggests teaching competencies which, though closely related to the foregoing, have unique colorings of their own.

The knowledge of a teacher must go far beyond the subject he is at any moment teaching. The wider, deeper, and more current his knowledge, the greater his ability to make curricular choices; to enrich his teaching by appropriate references to adjacent disciplines; to keep the motivational level of his class high; to take advantage of current developments in the field, and to differentiate his technique according to the varying talents, interests, and needs of his students.

In addition, he must know his subject in terms of its own characteristics, particularly as a discipline to be learned.

Teaching viewed from the stand-point of the development of the student yields a walth of needed teacher competencies. Knowledge of the student provides the absolutely necessary foundation. Difficult as this requirement may seem for the teacher faced with the necessity of teaching many, the more knowledge of each individual student - his abilities, his needs, his background, the motivations underlying his behavior, his talents, his handicaps, his home and peer relationships - the better the basis for dealing with him effectively. The classroom teacher, the lecturer to a large group, even the teacher on television who may niver see one of his students must form an image of a specific student as a listener, and fashion the presentation as if for him alone. (Television advertisers check their clientele continually to discover the current nature, reactions, and needs of the audience they are reaching and trying to educate regarding their product.)

A particularly subtle but necessary skill of the teacher is to recognize the nature and needs of a student as revealed in behavior. The shy, withdrawn pupil who participates minimally or not at all in activites of the class; the aggressive extrovert who seeks to dominate; the attention seeker; the defier; the one who curries favor; the absent-minded day dreamer - all present the challenge of discovering the underlying causes capitalizing on traits that enhance, and modifying or neutralizing those that inhibit learning. Particularly crucial is the need to recognize symptoms of emotional disturbance and to recommend professional care.

Since teaching is essentially a social function, the classroom teacher must understand and be skilled in guiding the dynamics of group behavior, particularly as they affect the progress of individual learning. And since individual learning must manifest itself in activity, he must be skilled in ways of so organizaing and directing the activity of large and small groups as to insure maximum individual participation.

Certain aspects of teaching require special attention, particularly since they represent areas that - because of their subtlety, complexity, and difficulty of assessment - are frequently neglected in preparation, choice, and supervision of teachers. In no profession is the person of the practitioner, as he affects the welfare of others, as crucial as in teaching. In our own society, students are exposed to the influence of teachers for a major portion of their growing years. Therefore, the kind of person a teacher is, as viewed by the students, may be crucial in character development.

The teacher must learn to appraise himself,realistically, estimating his own motivations, feelings, and prejudices, strengths, and short-comings as a person; and he must then be able to discern the effect of his actions on the behavior and attitudes of his students.

Another set of required teacher competencies involves the physical setting aiming not simply for the use of aids, but for student learning. The teacher must seek the best possible use of available facilities and equipment, including those in the community, hot only to enrich learning but also to make his students aware of educational and cultural resources available to them, and to encourage learning as a lifetime goal, if the student is to become independent of the school and find this own expedients.

The teacher also must develop his role as a participating member of a academic community of colleagues - both peers and superiors. The same holds ture, though with different imperatives, in his relations with parents, singly or organized, community groups with a concern for the conduct of education, and government agencies and officials.

Finally, the best teachers will exercise leadership in their profession, become active in professional councils, and seek continuing improvement in educational quality. The final task is to consider the process of teacher education in relation to attainment of these competencies, and to assess the functions of teacher education programs in providing media, both old and new, for their optimum development.

Chapter 2. Functional Characteristics of Teacher Education Programs

Effect of Past Experience as a Student on Teaching Methods

It has often been said that teachers teach the way they have been taught. While no experimental evidence has been found to support this allegation, it serves to illustrate a distinctive relationship between training and practice in the profession of teaching.

Prior to becoming a teacher, the teacher has spent a minimum of 16 years being taught. Whether he is a future elementary school teacher, secondary school teacher, or college professor, his background, unfailingly, will include extended experience as a student exposed to the level of teaching he will himself enage in. For the major part of this life, he has been in school and has been taught; as a teacher he will continue to be in school, but he will teach. This reversal of roles is responsible for several unique functional characteristics of progress of teacher education.

In a sense, the process of becoming a teacher consists of gradually shifting one's role from student to teacher. In this process, remembered experience as a student can play a significant part. The recency of the experience may be a factor, and to some extent, this experience has significance at all grade levels and must be reckoned with, both as a possible resource and as a possible problem.

As a resource, it provides some basis of prior personal experience with which to compare current observations and study about teaching. On the other hand, since the experience is in the past, and not recapturable except through recall, which is notoriously fallible because of the distance of its subject from the present and the delayed change in role from experiencer to observer, it can provide a most uncertain basis upon which to exercise judgment.

The teacher-to-be has another, probably more promising resource inherent in the process of his training. He is a student and the recipient of teaching. It is inevitable, therefore, that in the process of becoming informed about the teaching process, he will begin to consider his own application of the process. Such a student, therefore, is in some part already a teacher.

For the future elementary and secondary school instructor, the teacher education program can provide an opportunity for this two-level experiencing of training in spite of differences in reqhirmmants and characteristics of teaching at higher and lower levels. Sufficient common elements of teaching exist at all levels to provide useful and general applicable examples, even in higher education. Where characteristics are different, they can provide useful bases for comparison. But most crucially, a program for the preparation of teachers should itself be a model for teaching, embodying the most effective and most current procedures and concepts of curriculum. Because it is inherently an example of what it purports to teach, it can embody, within itw own curriculum and procedures the very qualities of teaching sought in its students as well as the cutting edge of new developments in the art and science of teaching, both those of already proven workth and those where effectiveness needs further exploration and where teacher education institution should take the initiative.

Classification of Learning Activities

With self-conscious, self-revealing, and self-illustrative characteristics of teacher education in mind as a leit-motif affecting all facets of the program, one can consider these particular functional characteristics reqhired to achieve results discussed in the previous chapter.

The outcome or results of teacher education have been classified in terms of teacher competencies. These in turn were classified according to: (1) knowlege of the goals of teaching and their implications; (2) knowledge of subject matter and skills to be taught and their influence on learning and teaching; (3) knowledge of students and social and individual factors affecting their development; (4) knowledge of environmental and social factors affecting the school and its functions; and, (5) self-knowledge, self-development, and self-appraisal by the functioning teacher. In considering translation of these

In considering translation of these outcomes into mediating learning activities, one can distinguish two large functional categories - the foundational and the instrumental. Teacher education studies can be placed not necessarily in one or the other, but rather on a continuum, with the two descriptive categories at opposite ends with most of the studies themselves embodying both in varying degrees.

In the case of outcomes requiring knowledge of students, a foundational approach will seek generalizations on such topics as the developmental characteristics of childhood and adolescence, the dynamics of individual and group behavior, and the nature of learning, while the instrumental approach will particularize the characteristics and behavior of specific students and groups of students in terms of their implications for teaching. The former approach generalizes; the latter particularizes. Each can use the method of the other, however, but for a different purpose. The former will use the study of a particular child, but for the purpose of inducing and illustrating generalizations about the characteristics of children. The latter will use generalizations about children for deductive purposes in order to understand better the characteristics of a particular child. The former seeks knowledge and understanding largely for its own sake; the latter seeks to find the operational implications of knowledge. One emphasizes understanding the theory; the other, understand of and ultimately skill in its applications.

In the case of the outcome relating to subject matter competence, the foundational approach will build a background of knowledge of the discipline itself. The instrumental approach will consider the material for teaching disciplines at various levels, building skill in making curricular choices from the vast material available, and in organizing teaching units of subject matter. In its most-directly-instrumental manifestation, the treatment of subject matter will concern itself specifically with material that will be planned for a specific, identifiable group of students, as in a curriculum workshop for teachers in service. In its most-directly-foundational manifestation, the treatment of subject matter will concern itself specifically with the causes, events, and consequences for example, a revolution in a college course on modern history, not necessarily for the purpose of understanding the subject from the point of view of teaching it to others, but for its own sake.

In the case of those outcomes involving the environment for teaching, study of the school as both a reflection and instrument of society, for example, will be largely foundational; but study of a specific social neighborhood and its influence on the functioning of the school will tend to be more instrumental.

Those outcomes having to do with the individual's own development as a teacher, his appraisal as a person and how he functions in a teaching situation, are almost entirely instrumental in nature. To be sure, foundational knowledge of the nature of personality, motivations, the interpersonal dynamics of the classroom will be useful; but in the final analysis, it is the future teacher's own personality and his functioning in the social situation of teaching that will need analysis, study, and development.

Both approaches, therefore--the foundational and the instrumental--have their place in the curriculum of teacher education. Neither is necessarily more important or more pervasive than the other, except that the ultimate aim is, after all, essentially instrumental - the development of a teacher who can function effectively and contentedly in the classroom.

Because of this most pragmatic culminating aim of professional training, direct, supervised experience in the actual, nonsimulated, professional situation usually is the final feature of preservice training. Just as the future physician serves as an intern prior to launching his practice, the teacher serves as a student teacher or intern before he assumes his first regular teaching position. As a student teacher, his studies are highly instrumental - he observes the classes and teachers in the rooms to which he has been assigned, and gradually assumes responsiblity for teaching under the watchful eye of an experienced teacher and the college supervisor. The directly pertinent observation and practice in taching presents the instructional problem of assistant a new teacher to develop skill helping him to see his actions from the viewpoint of others, to evaluate them, learn from them, and modify them if necessary. As both a learning and teaching problem, it is highly personal, individualized, and complex. There is no more threatening task than to be objective about oneself, and to see oneself as if with another's eyes. An actor must achieve this as must a dancer; it is even more necessary for a teacher.

In addition, there is the complex problem of establishing commonly accepted criteria for teaching quality appropriate to the group being taught, the subject or skill being taught, and the personality and srengths of the teacher. With so many variables involved, and with the individuality of the college supervisor and the requirements set by the school as added factors, the problem of setting standards whereby apprentice teachers can be evaluated, and which they can attain through supervision is difficult. While there seems to be little question in the minds of the profession (and even of some of the most vociferous critics of existing programs of teacher education) as to the value of direct preservice teaching practice, its proper organization, direction, and evaluation remains a major challenge and subject for further exploration and experimentation.

A second order of direct order of direct experience, characteristic of all in programs of teacher education, largely instrumental in nature, is that of observation of students and teachers in school and out-of-school behavioral situation. These observations are used most frequently to provide demonstrations and examples of teaching methods and student behavior in a variety of learning, testing, counselling, and play situations in schools, clinics, social agencies, playgrounds, homes, and any other areas where children congregate. This type of observational experience is intended to provide pertinent, true-to-life examples of teaching-learning behavior in studies, both instrumental and foundational, in support of such studies as learning, social behavior, curriculum teaching methods, the school, and the community. Proper planning, conduct, and utilization of so many diverse kinds of observations present a whole range of teaching problems. Visits to schools are not only time-bound-one must be there when the particular class is in session - but they are also time-consuming - a single hour's observation may require as mush 3 hours of a student's time in getting there, observing, and getting back. The problem of control of the course of observation is significant as well. If the object of the teacher trainee is to observe a lesson in ninth-grade social studies at the stage of initiating a new unit of work, and the observation is one of a class in its normal course of activity, the hour may be less than helpful because of changes in plans determined by exigencies of the immediate situation. On the other hand, if the teacher presents a demonstration lesson staged specially for the observation, it may lack typical quality necessary to give a true-to-daily-life example. Another problem is the need for ability by the observer to see what is pertinent a professional skill by no means easily developed. When the facilities, logistics, and the human requirements dictate the presence in any given school room of one or more observers, the problem exists of noting comparable charcteristics and of pooling impressions of 30 or 40 unskilled observers. When many may observe in the same hour for instance, by looking into a room equipped with one-way-vision glass or by closed-circuit television (a great boon to accuring comparability in observations since all, including the instructor, see the same thing at the same time), the problem arises of the artificiality resulting from the specially equipped observation which may lead to a less than typical reaction. Similar problems pertain to observations of children being tested in a clinic or brought into a college class for the same purpose; to observations of play therapy, of information behavior in a playground, on the street, or in the ome. Pertinent demonstsations require planning, special arrangements, and facilities and are, therefore, subject to limitations of a typicality and artificiality. Naturalness of observed behavior necessitates eavesdropping on typical slices of classroom, clinic, or neighborhood life, but demands excessive time for observation to overcome the fact that such life was not organized for observation and for pertinence to the observer's needs. The goal sought will determine requirements for the observation session.

A foundational study of the variety of school organizations typical of an urban community may require group visits to representative types of schools, conducted on a largely unstructured basis, in order to secure a wide range of experience and impressions for subsequent college class discussion and report. An analogous unstructured visit may be required for the highly instrumental study of a specific neighborhood served by the school to which student teacher has been assigned. On the other hand, a study of methods of teaching reading will require structured demonstrations of techniques to be learned. A study of ways to stimulate and guide the discussion of controversial social issues among high school students will require a demonstration that will be pertinent, typical, and at the same time illustrative of problems involved and ways of handling them.

This multidimensional use of observation of students and teachers in formal and informal life situations, both in school and in the community, is becoming more and more characteristic of teacher education programs. In its way, this circumstance presents problems of function, organization, and teaching which are as serious as those of the direct experience in practice teaching. As will be seen later, improving, the observation function is a major preoccupation of new media research and experimentation, as is, to a more limited extent, the improvement of student teaching.

One of the most challenging features of the training need of many teachers is the fact that so much can be undertaken while the teacher is on a full-time teaching assignment, either outside of regular hours during the school year or on an intensive full-time basis when school is not in session (usually during the summer recess). While some of this training is on a temporary "catch-up" basis, made necessary by teacher shortages and a consequent need to place relatively untrained subprofessionals in the classroom on short notice, and to make provisions for bolated training after employment, it is nevertheless emerging as a common pattern in the normal course of teacher education. A beginning teacher is trained in college on a full-time, preservice basis, in a program combining foundational and instrumental studies, culminating in supervised apprenticeship training. He is then hired as a full-time teacher, usually with a provisional license, after which he continues training (concurrently with teaching) until he receives regular and permanent certification.

Another king of training program that can parallel teaching is designed for the already fully licensed, experienced teacher who wishes to qualify for advanced specialist positions in such fields as guidance and school counseling, supervision and administration, or teaching the handicapped. Another is in response to the need for bringing experienced teachers up to date on major changes in the state of knowledge, as in the case of the "new" mathematics and atomic physics and their implicatians for change in curriculum, instructional equipment and procedures, or on major changes in curricular concepts and methodology, as in the case of audiolingual foreign language teaching and the proper use of language laboratories.

This combination of needs to supplement training of under-qualified "emergency" teachers, to complete the training of beginning teachers, to educate experienced teachers for advanced professional speciality functions, and to keep teachers abreast of the latest developments in the state of knowleged and in the art of teaching requires programs designed either for the part-time student engaged in concurrent full-time teaching or the temporarily full-time student engaged in short-term intensive study during periods when he is not teaching.

Such programs present their own instructional and learning problems. One is simply, but crucially, a matter of logistics - the transportation of students to centers of instruction, less of a problem in urban areas with easily accessible university facilities, but extremely serious in less-populated areas not within commutation distance of such facilities. Another matter is the sort supply of teacher education personnel which shows no sign of abating, particularly in the speciality areas representing the greatest need.

The conviction is growing that there can never be enough institutions of higher education with sufficient accessibility and capacity to meet the burgeoning need for the inservice training of the teaching profession to provide on-the-premise facilities for all those who require training. Nor will adequate numbers of teacher-education personnel ever be available to provide in-person instruction where needed. Whether the need is permanent or temporary, however, it exists now and for the immediately forseeable future, and must be met. In exploring ways pf overcoming the shortage, perhaps experience can be gained which will lead to permanently effective improvements in teacher education in the future, whatever its needs and conditions.

This combination of need to provide for instructional inservice requirements of teachers, not in physical conflict with their teaching duties, and to make available as widely as possible the services of the teacher education specialists, has sparked an exploration of the use of mass media and programmed self-study materials, either separately or in combination, and either in place of personal attendance is professionally guided group sessions or in combination with them. The extent of these explorations and the evidence available of their effectiveness will bediscussed in a later chapter.

A prgoram of professional training plays a dual role in its relationship to the profession and institutions it serves - it must prepare practitioners to operate effectively with currently existing conditions and requirements, and it must also lead in continuing improvement of the profession. In teacher education, therefore, one must prepare them not only for things as they are but as they can and should be, in addition to paving a way for future advancements.

Conditions, resources, and direction of leadership vary from school to school and from school system to system. A training program must, therefore, provide preparation that will assure the teacher of security through competence in a wide range of teaching situations. It is as indefensible to prepare a teacher to function only along the lines of newest procedures, with the latest equipment, in the most modern plant, and under experimentally oriented leadership as it is to prepare him only for an old-fashioned school with out-of-date teaching practices and facilities bare of modern teaching aids. As an instructional problem, it requires a functional balance in training between the new and the old, the latest and the conventional, the real and the ideal. In addition, it obliges the training program, oriented as it should be toward the best and most recently developed in concepts and practices, not to produce graduates who are incapable of seeing any good except in what has been discovered recently. For centuries, good language teaching has been achieved without laboratories; the absence of closed-circuit television did not prevent effective science demonstrations; the lack of a 16-mm sound projector and a library of teaching films did not prove fatal to the proper teaching of social studies. Basically, of course, the need is for an orientation toward both new and old media that will keep them in their proper place as radiating or helping instruments, not as ends in themselves. At the same time, however, in a program of teacher education, media do become ends, in that theyconstitute a necessary subject of instruction. Therein lies the danger that, in necessarily being treated as ends in teaching their instructional use, media may assume an importance in their school applications not in keeping with their limited function as means. This is not a new dilemma in teacher education; the old text and workbook slave is cut from the same poor cloth as is the slave to documentary films to television lessons, to tape-recorded language exercises, or to a filmstrip library. An important functional characteristic of teacher education is, therefore, the necessity of working within the framework of a full range of present school practice, and, at the same time preparing teachers for what has been newly developed or is just over the horizon.

Programs of teacher education cannot be restricted to following, digesting, and utilizing concepts and procedures that have been developed elsewhere. Teacher education has the inescapable responsibility of providing leadership in education at the school level, not just as research centers operating outside and above, but within and in cooperation with the schools themselves. This function requires thorough familiarity with the schools and their constantly changing environment, character, and responsibilities. It requires, in addition, the use of schools as centers of controlled experimentation, trial, and demonstation. And above all, it requires a cooperative working relationship between school and university personnel, a relationship which receives its most efficasious stimulation through experimentally oriented graduate university programs for higher teacher and school specialist training. As will be seen later, many experiments and demonstrations in the use of new media have resulted from such university and school system collaboration. In this function, the teacher education program serves not only itself but also the schools for which it exists. This function has long been assumed by the medical schools for their profession, but a real question exists as to whether the universities engaged in training teachers have been fulfilling this function adequately.

With this foregoing as a background, it is now necessary to consider the assumed functional characteristics of new media before an evaluation can be made of their applications to teacher education.

Chapter 3. Use of Media for Organized Presentation of Learning

Instructional media are ways of organizing materials so that they can be learned more easily. One of the early examples in western culture is the catechism in which organized religious doctrine was presented according to a more or less developmental sequence, segmented into small units in the form of memorizable questions and answers. This catechetical programming of learning material was relfected in basically this same form in school textbooks well into the 19th century, with the addition of illustrative pictures (as begun a centruy earilier by the Moravian Bishop Comenius in his Orbis Pictus), and the gradual transfer of questions to be back of each chapter. Gradually the relationship between text and question become less one of an exact, undeviating stimulus-response relationship requiring rote learning. The text became more and more a coherent, didactic narration, and the questions required less reproduction of exact text and more application of thought and interpretation. Textbooks and so-called workbooks, both old and new, represent, therefore, materials programmed for learning and instruction, and are still the most ubiquious media of instruction. They are not, however, considered to be new media, except, perhaps, in their most recent manifestiation, those ultra-organized and systematized programs of learning materials that have given special technical meaning to such terms as programming and self- or auto-instruction, and are known most popularly, if somewhat inaccurately, as teaching machines. Of these, more will be said later.

The advent of the motion picture, particularly the motion picture with sight, and sound reprducible from the same film medium (and packaged in convenient, relatively inexpensive 16-mm; and now even 8-mm sizes, broght the promise of a new medium of instruction. While the motion picture has, admittedly, had more impact on our society as entertainment rather than as instruction, many thousands of instructional films have been and are still being produced for use in schools. The development of sound recording and transmission presented another series of new media from the pressed phonograph disc (which has left an indelible stamp on music appreciation classes), to radio and sound-recording tape. With the advent of radio, the first medium of mass communication to challenge print, its educational potentialities received their first really significant stimulus, particularly with development of its companion, the tape recorder. From television and its indispensable helpers, kinescope and video tape recorders, this process received its most dramatic stimulus, particularly in view of the pervasive, almost hypnotic influence of the medium on the habits of society in general and school-age children in particular.

All these media simulate reality, but at a level closer to direct experience than an abstract symbolization of the printed word. Ratio and sound recordings, films, television, and video recordings use sight and/or sound to give a closer illusion of actual presance. In addition, live radio and television bridge space by bringing the listerner and viewer into the immediate simulated presence of events as they are happening. In their recorded forms, they can bridge time as welllby capturing the sight and sound of events as they happened for replay and experience as many times and in at many locales as is doomed necessary. These media have become so much a part of daily life that it becomes difficult to conceive of a time when they wure not universally available. The student today can, from a remote place, view a volcano erupting a war being fought, a ship sinking, an astronaut in orbit, and a ball game; hear a speech; and attend international meeting at the time they are happening. If he misses seeing or hearing the event, he can witness it later.

This phenomenon of living in the sensual presense far-away happenings is such a pervasive part of our environment that it has to a significant extent, influenced opinions, buying habits, voting, avocations, and recreations, and shaped in these and countries other ways, the daily course of men's lives. In a very real sense, then, these media have educational effect in that they help influence behavior. Their applications to learning in the scholastic sense, involving the formal organization of instruction and learning, are another matter; for outcomes are necessarily more narrowly defined, requiring tighter organization, a much longer time span, and a much more sustained and active learner response. In addition, these media have been designed and conducted for a mass market; they concentrate largely on casual entertainment and have been applied to education almost as an afterthought, as a peripheral, relatively unprofitable activity of the communications industry. Therefore, they attract only a fraction, and that by no means the best informed or creative of the guiding personnel having appropriate technical skills. As a result a considerable proportion of educational applications of the new media is amateurish in quality. This may prove to be a deterrent to acceptance since students are subjected to entertainment in the same way which often is of extremely high professional caliber.

All these media in their standard, prevailing forms, although adapted and not specifically planned for formal educational use, have their applications in education much as do newspapers, magazines, and trade publications. A film adaption of *Wuthering Heights* or a video presentation of *Twelfth Night* for an English class, a television "special" on the conflicts in East Asia and North Africa, or a radio broadcast of a United Nations Security Council session for a social studies class - all provide the material for formal education, as do novels, essays, magazine articles,adnd newspapers. As an integral part of the environment of cilization, they are now an indispensable part of our educational resource. In addition, they have broadendd the demand for literacy, bringing skill in lestening and observing on a plane with reading.

The new media as instruments of planned pedagogy present unique characteristics, challenges, and problems. Textbooks about literature differ from the literary works themselves. A year's file of the *New York Times* is quite different from a study outline on current events and a scientific journal is not like a laboratory manual. Pedagogical manipulation, production, and use of new media concern us most at this time.

Cost a Factor

Since television, combining both sight and sound, represents a more rounded and less restricted stimulus than does radio and sound type recording, it has the potential of being used for a wider number and kind of applications than does the latter. On the other hand, the great cost of film and television production, and the high cost of closed - and open-circuit television transmission systems, compared with more modest expenditures for sound production and reproduction systems, have influenced not only king but frequency of use. Cost, therefore is an important consideration, and economic pressure to use the more expensive media for nearly the entire course is considerable, since only in that way can the high unit cost be justified. During teacher shortages the possibility of reaching hundreds and thousands rather than dozens with the same teacher is tempting, especially when this expedient affords the possiblity of making quality teaching and most recent subject matter available to the largest possible student population. A case in point is the Harvey White course on Modern Physics, given first live on television and then made available in a complete set of 16-mm. sound films. The opportunity to learn from a master, using the latest equipment to present the most modern developments in his field, surely justifies the wider possible distribution, particularly since teachers of physics are in desperately short supply.

Limitations of Media

However, certain limitations of media as instructional tools must be understood, perticularly if they are to do the whole or nearly the whole of teaching. Sound film and television present instructional stimuli with students in the simulated but not actual presence of a teacher. The student cannot ask questions, manipulate materials, or influence in any way, either visually or audibly, the course of teaching presentation. Nor can the teacher note student reactions, ask questions, invite comments and questions except by mail, or in any way modify teaching immediately according to student response. This medium, therefore, lends itself to presentation experienced vicariously. Because of this functional limitation (and presumably because of the "goldfish bowl" existence of the teacher on film or television who can be watched by large numbers of students as well as colleagues and experts), the presentation, to be effective, must be prepared, produced, and performed with great skill and care. The assumed audience must be identified and the level of difficulty determined accordingly without ever having reference to specific students as has the classroom teacher. The posited attendance-span of the assumed audience must be considered in establishing the proper balance between the visual and verbal. Interest and motivation level must be sustained at a pitch that will help make up for the absence of the physical presence of the teacher. The teacher, in being restricted to the presentation function, and in not having the opportunity of knowing and working with his students directly, must make up, in performing skills, and in his choice of TV presentation techniques, for some of the more intimate techniques of teaching he be prevented from using. And the student, deprived of personal acquaintance with the teacher and the opportunity to ask questions and,,in turn, be questioned by him, is left with the responsibility of being the complete spectator absorbing fully what is being presented, and of keeping his attention at a sustained pitch.

In the extreme application, the student in a television or filmstrip course is completely on his own as if he were reading a book, except that he cannot reread a page, pace his reading, skip or look ahead. His television course serves as a complete, self-contained entity, without local intervention by a mediating teacher, although a variation may involve the use of local instructors who conduct question, answer and discussion sessions to supplement television presentations, This is analagous to the conventional division of some college courses, particularly in the natural sciences, into large lecture sessions given by a senior professor, followed by dependent, small recitation classes led by junior staff members.

A similar variation, but closer to contact with local conditions, is the use of an internal, closed-circuit television system for widely dispersed, simultaneously scheduled presentations by experts followed by small group discussions in the viewing rooms, directed by an assistant instructor. In theory, the presenter of live television programs, being on the staff of the institution served, can be responsive in subsequent presentation to student needs as noted by locally based colleagues. In some applications, an ingenious feedback system of student microphones and lectern lights is used for immediate communication between students and presenter.

Use of Media for Self-Appraisal

To some extent, particularly before the development of television, the potentialities of radio were explored as a medium of formal teaching in much the same way as television, though not nearly with the same degree of professional involvement and financial support. But because of its restriction to auditory stimuli, the dramatic, superseding development of television, its use as a teaching medium has waned. The tape recorder, however, has brought into prominence another function of the new media - self-appraisal. The new familiar language laboratory takes advantage of the immediate playback and erasability of sound tape - properties shared as well by videotape. (New developments in film processing make possible almost immediate playback of motion picture and kinescope film, but without the erasability feature that makes electronic tape the flexible reproducing instrument it is.)

With sound tape, it is possible for the student to hear himself as others hear him, and with videotape (and film), to watch and hear himself as he appears to others. Because of the low cost of sound tape and the small size and weight of the gear which both records and plays back, the number of possible educational applications using the process of self-appraisal is limited only by the imagination and will of the user. The most widely used applications are of course in language learning, in which many varieties of exercises using models for comprehension, imitation, and comparison with student performance are employed. Tape recorders are now so common and so well within even modest personal budgets that they are finding their way into homes as well as into institutions, thus opening the way for individual home use by students. Their ease of operation and their portability, and facility in recording and playing back with fidelity anything fed into them, make them one of the best do-it-yourself educational mediayet devised. Certainly there is little to prevent their ultimate availability so every teacher and classroom when needed.

Videotape shares the same properties and potentialities as sound tape; but with the addition of a moving visual image, it opens an even wider field of applications than does sound tape. In language recording, it provides a more multi dimensional communication image since facial expression and gesture are as much a part of speech as sound production. For the function of self-appraisal, it provides not simply the mirror image that one has learned to accept but at at the image that others see. In theory at least, it can provide learning applications in any situation in which the projection of one's own sound and sight image is desirable. The act of teaching is an obvious example. Unfortunately the high cost of videotape and its associated gear is a major deterrent to its use in these highly individualized applications. Sharply reduced cost and the prospe prospective development of portable versions of videotape recorders makes wider institutional use a definite possibility. although the process may never because of its inherent greater complexity, become as cheap and convenient as sound tape recording.

Any medium usable for self-appraisal will serve for appraisal of self by others or evaluation of student performance. An obvious examples is appraisal of student performance in imitating either by direct monitoring in a language laboratory or subsequent analysis through playback. A further extension of this use of recordings, both sound and video, is for research into any human phenomenon involving observable and hearable behavior. Before the advent of sound-and-sight recording, such research was limited to living festations observed in action, and therefore subject to the falibility in human recall and a tendency to introduce variations dependent on the nature, bias and ability in expression of the observer. The sight-and-sound recording of an event, however, can be replayed often, and can be heard and seen by many witnesses. This quality of capturing visible and audible images of human behavior, and making them instantly available for use and reuse, render these media spectacularly fitted for research into any problem that has to do with human action and interaction.

The Teaching Machine

Finally, no discussion of new media is complete without consideration of the teaching machine or the programing of auto-instructional materials. As yet, more written about and experimented with than widely applied in schhols and colleges, the teaching machine movement represents an attempt at making self-teaching possible through rigidly controlled manipulations of sequential stimuli and student responses. In some cases, devices are used to assist the process, ranging simple, box-like devices that expose new printed material and conceal the old and what is to come, to sophisticated, complex mechanical and electronic devices using combinations of visual projection, push-buttons, and indicator lights. However, the key is not in the devices themselves but in the arrangement or programing of learning material. (Therefore, "teaching machine" is a misnomer, it is not the machine that teaches but the material.) Emphasis now is more and more on printed, programed materials that can be used without accompanying and enabling gadgetry. Material to be learned is programed in small sequential units called "frames", consisting of presentation (e.g., a problem in mathematics or a statment of principle in physics), and response material (e.g., questions, directions, and either alternative answers from which a choice is to be made or blanks in which the student enters his response and immediately compares it with the correct answer which he uncovers). If his response is correct, he goes on to the next frame; if it is incorrect, he either returns to the original stimulus material and tried again (in the case of so-called linear or fixed-sequence programing), or his incorrect answer leads him to a corrective section which explains why it is wrong, and he can then try again (in the case of branching or variable-sequence programing). Usually, linear programing builds its frames in such a manner as to achieve low probability of student error, doing this through carefully organized and graded small-unit sequences of instruction that build upon one another in a single, undeviating line. The branching type, on the other hand, prefers longer stimulus units, sometimes a page in length, carefully written for didactic purposes, and makes provision for the student to learn from his mistakes. The ideal program, according to the linear concept, is one in which it is almost impossible for the student to err. The ideal from the branching point of view in to build into each program the most likely errors made by students and which, if made, can be actively removed by the corrective material. Both types use the principle of continuous reinforcement of student response to facilitate learning, and enable the student, in theory at least, to learn at his own pace and as far as the specific program material is concerned, without intervention of a teacher or class sessions in the traditional sense. Even though it is intended as a device for individualization of instruction, it is such only in the sense that a student can work by himself and at his own speed. He is subjected to rigid control, and must not deviate from the program. Even when alternative responses are possible, they and their consequences are controlled. The only option a student has (other than to quit) is to control his own pacing. He cannot skip ahead, go back, ask his own questions, or explore alternatives other than those given. On the other hand, he has the security of success. He receives continuous reinforcement in his learning progress and knows at every point in the program where he stands.

Its most enthusiastic proponents claim that these auto-instructional devices are the greatest advance in instructional media since the textbook. Its most vigorous detractors view with alarm its alleged dehumanization of the learning process, its undue fragmentization of subject matter, and it potentialities for "thought control." Some see useful applications in the teaching of logically organized process and fact-oriented disciplines such as mathematics, but little through programming of other than factual components of disciplines involving speculative, discoursive, or aesthetic experience. All agree that they key to effectiveness of this medium lies in the quality of its programs. Since the process of programing is so complex, requiring a combination of complete mastery of subject and its inherent characteristics as a discipline, and command of principles and processes of the program type to be employed (infused with considerable imagination and ingenuity), and since it is extremely time-consuming, it will be some time before a sufficient number of programs are available to challenge the textbook and workbook market.

The movement has spurred great numbers of experimental studies on the learning process itself (within, however, the psychological rationale of the auto-instructional movement), and promises to enrich considerably our further understanding of the ways in which knowledge is gained.

Chapter 4. Possibilities for Teacher Education in New Media

Contribution of New-Media to Teacher Education

Having considered the functional characteristics and requirements of programs of teacher education (which in turn must be based on teaching requirements), and functional characteristics of the new media, one can now consider ways in which new media may contribute to teacher education. The problem is too complex to yield readily to a more matching of functions, for circumstances and special needs have ways of introducing imperatives that may have little to do with intrinsic functions. If it is deemed necessary to acquaint large numbers of teachers in service withhthe latest developments in teaching science, and if sufficient facilities are not available within commuting distance of the clientele for face-to-face workshops with the expert and for opportunities to handle new materials and perform experiments under his guidance, then a television course must be considered. The evaluative problem is not whether this expedient would be inherently better for updating science teachers than workshops conducted in the physical presence of a professor, but rather, given the impossibility of the latter, whether a sufficient gain in knowledge and competency could be attained through television to justify the time, manpower and resources involved. A more justifiable consideration might be the extent to which a comparable job could be done with self-study materials in the form of professional bulletins with well-designed illustrations and exercises. Or even more pertinent, whether an educational television facility is already available with airtime and technical staff, and what ways of preparing, presenting, and utilizing programs for this purpose will best fill the need. Variables such as the number, kind, and quality of alternatives available, cost, and urgency of need may introduce considerations hhat will prevent free choice of training techniques based on intrinsic ability to do the best job.

Ways, therefore, of considering the possible functional contributions of new media to teacher education have meaning only when they keep the realities of circumstance and urgency of need in mind, as well as functional characteristics of the new media.

As to possible contributions to teacher education of these new media - radio and television, sound, film, and video recording, and auto-instructional programs, at the outset, it is obvious that the teacher must know about them and their use present and potential in the schools, and recognize their best time and place the new media as a subject of instruction must be a part of any modern teacher education program. Whether the instruction in use of new media should be separated into a special course, or be incorporated into more broadly conceived studies on methodology and learning must be resolved through professional practice, experimentation, and research.

On the theory that skill in the use of a medium can best be acquired by adapting it to one's own schooling, the possibility emerges of introducing the new media into teacher education itself, in order to develop in its student sufficient expertness in their use. Will a teacher who has in his own training attempted to learn a new language by use of audio-lingual devices become a better language teacher and provide better guidance for his students' use of the language laboratory? Can the teacher who has himself taken a course or a lesson or two via television better appreciate the learning problems of adolescents faced with the necessity of receiving instruction by television? Will a teacher who has himself prepared part of an auto-instructional program and who has subjected himself to learning a unit on associative learning by this medium better understand the psychological rationale behind the method and be able to use it more intelligently with ninth-grade students in mathematics? Finally, to what extent can teacher education reflect and embody in its own procedures and principles of instructional organization, the latest and most effective practices in the schools for which it trains teachers? The answer is not a simple one. There is, for example, the question of appropriateness to student level of the student. The clientele of teacher education is adult; to what exyent are applications of the new media to adult learning comparable to those for children and adolescents? Furthermore, shall teacher education institutions uncritically accept all innovations in methods and curriculum because they are there? The solution in each cases lies ultimately in what experience, exploration, experimentation, and controlled research can discover about, for example, the appropriateness of each method for the developmental level of a student, and the values and limitations of each of the new media and their many possible variations, adaptations, and combinations in learning, and teaching. In these explorations, teacher education institutions will be expected to lead in cooperation with the schools, thus enabling them to intelligently conduct their own programs.

Observational Experiences

A major functional characteristic of teacher education programs is to provide observational experiences which enable teachers in training to observe realistic situations involving children and teachers in a wide variety of learning activities, in and out of school. The new sight and sound media, in their ability to transcend space in "live" use, and both space and time in recorded use, provide the opportunity to extend in number and refine in function and scope the many kinds of observational experiences desired. With these media, a large number and variety of realistic examples of children and adolescent individual and group behavior can be made available.

Without the assistance of new media, the observational opportunities are subject to a whole series of limitations. A school classroom has a limited capacity for observers, and rarely can accommodate more than a few. In addition, the view of observers is limited since usually they cannot wander about during a busy class. Rooms equipped with one-way vision mirrors, while they remove the observer from the classroom itself, and often increase the number of possible observers, share the limitation of the one-sided view. Also the additional space needed for such installations and the resulting expense in capital construction have kept the number of such rooms and of schools having them to a very few, with the resulting artificiality of bringing classes specially into rooms so equipped. For clinic demonstrations involving individual students or, at most, small groups, such facilities seem to be more successful. Another problem of the "live" observation by small groups of students is the pertinence of what is witnesses to present needs of the observer. If his assigned object is to become familiar with the atmosphere of an elementary school classroom and theyway activities are organized, order maintained and unexpected problems handled, then a series of unstructured, random observations will meet specifications admirably. If, however, his object is to observe the handling of a lesson in reading readiness or the conduct of differentiated group activities in reading activity, the finding of a sufficient number of pertinent situations to be observed by a group of 40 students, sent out in teams of 3, at an appropriate time in the college semester, is almost impossible to achieve. And other problems must be resolved including conditions necessitating changes in plans, numbers of teachers involved, inappropriate classroom situations, extensive time, cost, or travel required.

There are, however, more serious limitations. Since a student cannot be expected to be an expert observer, it is most important that he be guided in what to observe, and, having seen, to make valid interpretations, so that these sessions will be fruitful and not a waste of time.

In this function, the new media offer intriguing possiblities, in that live, closed-circuit, or open-circuit television can solve the problems of dispersal of observers to many classes and require fewer demonstrating teachers, thus providing greater control over what will be seen.

Disadvantages and [illegible]

On the other hand, the views and vicarious, two-dimensional, subject to all limitations of the television camera lens (and the operator who guides it), as well as to inadequacies of microphones (which, not being as selective as the human ear, transmit everything, including all distracting noises), the transmission system, and monitors. In addition, the question exists of teacher and class distraction under the television camera eye. To what extent will the lesson become a self-conscious performance rather than the everyday life exhibit intended. Will the presence of cameras be more or less distracting than the presence of live observers? Remote control devices may obviate the necessity of having camera operations in the telecasting room and may reduce the possibility of serious distraction, but the consciousness or "being on the air" still may be a factor, as well as the need for special room treatment for lighting and acoustical properties, costly and extensive coaxial cable, and associated control and transmission equipment. Live television viewing shares several possible limitations in common with in-person viewing, the most crucial being that it is time-bound and events can be seen only when they are happening. College and school schedules rarely coincide, and the classes meeting evenings and Saturdays, or during summer months must be omitted. Neither school nor college can be expected to gear its own activities to the needs of the other, particularly if in so doing, its own students' prior need is neglected. Another limitation is the difficulty of controling what is being observed. To be sure, a communication system joining professor with the camera control men, particularly in a remote control system, can at least provide control over the specific images transmitted, but no control is feasible over the lesson itself as it unfolds. Similarly, there is a definite limit to the amount of prior agreement that is possible on the specific nature of the lesson in the live situation. Since much greater economy is possible with television, with one viewing serving many students at the same time, fewer teachers need to be dealt with than in the dispersed, small group, in-person viewing arrangement.

To offset limitations of time and control, recorded media provide interesting possiblities. Recordings can be made at the convenience of subjects involved, and they can be used at the convenience of viewers, over and over again, with the same or with other groups. Nor are they limited by space or equipment scope and range as is television. They can be sent anywhere, used wherever facilities are available, at a time - evenings, Saturdays, or in summer - at the point in a course of study when they are most pertinent, and can be controlled. Recordings can be made of many versions of the same lesson, using different classes and different teachers, then selecting only those desired. They can be cut, edited, spliced, or combined for specific instructional purposes. On the other hand, they are "canned" and lack the quality of immediacy. Editing requires technical skill and, unless done properly, may amuse rather than instruct a media-wise student body. Materials that are prepared in advance and used often may lose their spontaneity and become sterile, much as does the convenient documentary film or the series of fading prints above a chalkboard. Nevertheless, recorded media seem to be most promising in assisting the observation and deomonstration function of teacher education programs.

Differences in intrisic characteristics and requirements of various recorded media may affect their applications to teacher education. While sound film (taken by the motion picture camera and reproduced on a 16-mm. or 8-mm. projector), has admittedly the highest pictorial quality of sight-sound media, having the ready and feasible possibility of color, as well, it has limitations, particularly in fulfilling the observation function. Motion picture cameras cannot be operated remotely, and have severely limited film magazine capacity, making difficult the uninterrupted "slice of life" recording that this function normally requires. Television cameras, on the other hand, can be operated from a distance, need less special lighting, and whether they feed into a videotape or a kinescope recorder they are not part of the camera and are usually in a remote location), have uninterrupted recording capacity of as much as one hour. The videotape process has sound and sight fidelity, generally indistinguishable from live transmission; kinescope film is usually of somewhat inferior quality and is subject to the vagaries of a complex development process. On the other hand, kinescope film can be played on any 16-mm. sound projector, while videotape can only be played over a videotape machine. This amkes the kinescope film of much wider applicability in spite of its lower visual fidelity. It seems evident, however, that under present conditions, a combination of videotape for recording and of kinescope for subsequent copying and editing may provide the best possible combination of recording media for this purpose. Unfortunately, this might require an investment for recording machinery of between $50,00 and $75,000, plus necessary technical personnel, a cost factor that would preclude other than large university production facilities. On the other hand, as new recording devices are developed, such as the portable videotape recorders, and at a fraction of the cost of standard broadcast machines, sight and sound recording eventually may be within financial reach of most teacher education institutions. At any rate, the possiblity of central depositories for kinescopes and videotapes for loan to teacher education institutions as a supplement to live observation is quite feasible under present cost conditions. The problem, therefore, seems less one of cost and more of discovering what king of observation recordings, used in what ways, will enhance this essential functional characteristic of teacher education programs.

To some extent, sound recording has a place in this function as well. It is far more convenient in its technical simplicity, low cost, and extreme portability. A class session may be recorded much more cheaply and casually by sound tape than by videotape, with the former being in the do-it-yourself category, and the latter requiring specialized technical personnel and complex equipment. On the other hand, sound tape is completely unidimensional and may provide a highly fragmentary account of an educational event. For an observable event to be intelligible via sound recording alone, it must either have a dominant verbal character or be supplemented by on-the-spot commentary to supply in verbal images what is missing in natural sound transmission. As a consequence, since verbal commentary, as in a radio report of an event, usually is not possible in a sound recording of a class session, the recorded verbal image may be seriously deficient in reporting what actually transpired without a visual element. On the other hand, particularly if no other means of recording is available, some real value may accrue for example, in highly verbal encounters between counselor and student, student reports, and discussions in which the verbal image is dominant.

Other Possibilities

The culminating, preservice training task of the future teacher is his supervised experience as a student teacher, apprentice, or intern. Before he can be completely on his own, with full responsibility for the progress of students, he may work with students at a level between that of student, observer, and regular teacher, with the help and supervision of professionals from both his training institution and a school.

This practical preservice experience, from the point of view of supervisors, requires informed observation and guidance of the trainee's day-by-day service in the classroom; and from the point of view of this trainee, it encourages a maturing awareness of the quality and effect of his methods with students, and refinement of his teaching skills to a point of professional competency. Foundationally involved in these functions of supervisor and student teacher is the process of appraisal of student performance. In providing a real and objective basis for this function, one achieves a most promising possible contribution for the sound and sight media, particularly in recorded forms.

The problem of seeing and hearing oneself through the eyes and ears of others is crucial to the development of any performing artist. Even before the advent of new media, dancers and actors practiced endless hours before mirrors in order to perfect their own visual performing image. With the advent of sound recording, it has become commonplace for actors, musicians, and public speakers to record and appraise their own practice and performance for self-improvement. With the development of visual and, subsequently, audiovisual recording media, it then became possible for a performer to get an objective sight-sound view of himself. This real view is completely impossible without such recorded aid, for one's speech sounds quite different when he hears from within as it were, while he is speaking, and one's view of himself in the mirror is the reverse of one's real image as seen by others. In addition, as one acts and reacts, he does not have the time or the objective view to study and appraise his actions. When he is recorded, however, he can listen to himself and watch himself, as he has acted and appeared to others, and may replay himself as often as he finds it necessary to do so.

One can therefore speculate that recording sight-sound and sound media may provide a valuable resource in furthering the process of self-appraisal of a future teacher, indeed of a teacher in service as well. One assumes that a teacher must develop a certain ability to view his actions objectively, as he appears and is experienced by others. The very fact that one feels little kinship with one's recorded voice and image (since they are felt as being outside of one's subjective experience,) should help in viewing oneself objectively and critically. It is possible to some extent to make sound and film or video recordings of teacher actions in a classroom, to help him see himself as others so and thereby to stimulate his improvement. Technical considerations parallel those involved in recording classroom sessions for observation purposes; except that here the recording is for individual use, and a considerably higher unit cost is inevitable, no matter how valuable the application may be. On the other hand, the sound tape recording process is inexpensive and therefore feasible for single student use, thus making its unidimensional character probably a much more serious restrictive problem. Sound-sight recordings suffer most serious limiatations because of cost except in highly subsidized, experimental applications. The erasability and reusable feature of video-tape, however, offers some hope of future practicability, as does the further development of reasonably priced portable video-tape recorders. In any case, thorough investigation of these possibilities is feasible and is being explored.

The function of appraisal of teaching by others, so necessary in teacher training and in inservice supervision, also might be assisted by the new media. Whether the appraisal is by the college supervisor of a student teacher, or by a principal or chairman of department of a teacher in service, an accurate, representative view is needed of exactly what took place in the classroom, and professionally viable and objective standards must be applied. One can speculate on the possible aid to the supervisor of seeing a teacher and his students through the directed focus of several television cameras, in the case of live viewing, and of being able to replay a recording in order to make sure that nothing was missed in recall in the case of recorded television.

More crucial, perhaps, is the problem of standards of appraisal. In a large teacher education institution, the number of appraisal visits to student teachers runs into the thousands each semester, with scores of supervisors involved. If the primary function of school administrators, the improvement of instruction, is taken seriously, the number of such supervisory visits in school systems should be considerable as well, with large numbers of principals, chairmen, and other supervisory personnel involved. How confident is a college or school system that its standards of appraisal of classroom teaching quality are on an acceptable professional level, are based on agreed criteria, and that inevitable individual variations in judgment are within a desired range? Teaching appraisal is an area of largely undefined, unmonitored, and individualistic professional judgment. As a phase of professional training second to none in importance, it remains itself largely unappraised.

For this function, the new media, particularly in their recorded forms present promising possiblities. It is commonplace for a professionally minded English department to consider in committee typical examples of student themes in order to establish an agreed basis for rating and critique. Will a similar practice for college supervisors, using as a basis for comparative evaluation sound, videotape, or kinescope recordings of student teachers yield better supervision based on common standards of appraisal? Can use of recordings of teachers contribute to the better training of supervisors?

Even more far--reaching and fundamental is the potential of the new media for research in investigating the nature of teaching and learning behavior. The ability to capture in sight and sound the moving and audible images of behavior for subsequent and repeated analysis provides unprecedented resource for fundamental research. Elements of the teaching function, so often a subject of armchair speculation, can now be investigated with the aid of records that are not subject, in nearly the same degree, to the fallibility of human recall and anecdotal description. They are still subject to other limitations, the choice of camera views of angles, for example, being directed by human judgment; equipment limitations may result in distortion of both sound and image or fail to pick them up properly. But there is no question that the media can offer for analysis hitherto unavailable kinds of observational raw material in almost limitless potential quantity. The same recorded example of behavior can be replayed as often as desired, to as many observers as desired. The basic record is always available for study. It is now possible to analyze teaching and learning behavior not only from evidence gained after the behavior has taken place (through the results of tests, interviews, questionnaires, and/or anecdotal recall), but from analysis of the behavior itself, as it is seen and heard, in whole or in part, and repeated as many times as is needed. The old saw, "Nobody really knows what good teaching is," while always of questionable validity, appears even less realistic in the face of such promising resources.

It must be emphasized, however, that media offer only means, and that their proper manipulation and what they can and cannot transmit and capture must be thoroughly investigated and understood, particularly if fundamental research is to be undertaken. However faithful the recording, however true to actual sound and sight the reproduction, it is still a representation, removed by distance and time, as well as the mediation of recording gear, from the actual event being preserved. But it does widen, to a hitherto unavailable extent, the basis for observation and analysis, and open limitless horizons for research significant to teacher education.

Thus far, uses of media have been considered that represent aids leading to fulfillment of major teacher education functions, and in which the new media did not carry the entire, or almost the entire, responsibility for teaching. There are, however, possible uses in which media do not serve only as adjuncts, but are expected to carry the major function of course presentation. What possibilities exist for using the mass sight-sound media for presenting entire teaching training, courses, and what functions in the total teacher education program can such courses perform?

The question is complicated by circumstances and considerations which may make proper evaluation of such new media uses extremely difficult. Obviously, a medium that can reach thousands with a single presentation performs a real function since it is impractical to being these thousands to a central location for in-person instruction. The vicariousness of this medium, and the lack of individual student-teacher communication, may be of secondary importance if communication in the mass is the only way of reaching these students. Thus, when a particular geographic region has a considerable proportion of its teaching force in need of immediate upgrading in professional background, but is unable to use teacher education institutions within commuting distance, courses via radio or television may well be the solution. The problem becomes one of availability of suitable air time, of planning and quality of programs, choice of most needed courses, proper evaluation of student persistence and performance; but it is not necessarily one of determining whether a face-to-face approach might have been more effective. Of legitimate concern are such considerations as the best means of making the experience more than a spectator activity by organizing discussion groups, perhaps coordinated with the programs, and by arranging questions, examinations, and assignments by correspondence, telephonic feedback to the instructor or his assistants, and other devices to assist and control learner activity.

Another problem is the kind of course since, for a mass medium, sufficient numbers must make use of each presentation to justify the cost. Obviously such a choice must consider need. The question of whether a subject lends itself best to presentation by a mass medium is of importance only to the extent that circumstances make a choice on this basis possible.

Granting that emergency situations (arising from a shortage of professionals and the inability of teacher education institutions to expand in proportion to need) create possibilities for aid from the new media, a ligitimate question is still the extent to which such aid is indicated per se, without the complications of emergency need. What functions of teacher education lend themeselves in significant measure to new media applications in the complete or nearly complete sense?

In this connection, the inservice training needs of the profession are worth considering. These are (excepting the emergency needs of substandard teachers without mimimum qualifications), of two kinds - those that will bring the beginning, provisionally certified teacher to full permanent certification, and those that will bring the already-fully-certified teacher abreast of the latest developments and changes in his field. The trend toward requiring 5 years of preparation beyond high school for all teachers, and of encouraging further training beyond that period, will result in a steadily increasing need for expansion of inservice programs. Is it necessarily inevitable that all such further training be considered an extension of undergraduate work, to be taken in much the same way, on university campuses, or in lecture halls and classrooms? Or are there certain elements in this further training that will lend themselves well to mass media applications, thereby reserving for residence work on campuses those aspects of training that require personal use of university facilities, the physical peesence of instructors, and the communal learning stimulus of student groups? In such a division is possible, expanding inservice requirements for the profession of teaching could be met without creating unrealistic plant and manpower demands on already overtaxed universities. Can it be assumed that the motivational level, and the autodidactic ability and determination of the teacher in service, is sufficiently high to make less important the personal guidance of an instructor, and to make courses given on a purely presentational basis, as of necessity are those given by mass media, sufficient to meet requirements of an adult, professional clientele? If this is so, what elements in the inservice curriculum lend themselves best to this kind of presentation? What kins of feedback, followup, and evaluative measures andddevices are necessary to satisfy requirements of the profession, as variously interpreted by school, university, professional society, and public authorities? What combinations of individual listening and viewing, university attendance, and local seminar meetings best satisfy both professional and individual objectives? And finally, to what extent do mass media presentations add a significant dimension to this type of adult, professional learning that cannot be achieved by self-motivated individual study on a reading, assignment, and test basis, taken under university guidance through correspondence?

The availability of production, transmission, and receiving facilities looms large in this area of professional training via the mass media, particularly television. A teacher education clientele, in need of subject matter pertinent to its professional function, will of necessity be much smaller than a secondary school or general adult clientele. The Harvey White physics course was designed for a wide, largely amatueur audience interested in an introduction to modern physics; a course for science teachers who already have an adequate basic preparation in the sciences, however, would have to be pitched to a much higher level, and designed for a more specialized and for that reason a much more limited audience. This requirement would take such a course out of the realm of the "public service" segment of commercial network television and transfer it to the more modestly budgeted and more restricted noncommercial station, whether it be on very-high or ultra-high frequency, the projected 2000 megacycle band, or university-school system closed-circuit installations. In addition, unless broadcast over very-high frequency, their receiving possibilities are restricted by the number of specially equipped sets available to their clients, a restriction still of considerable moment. Radio, particularly in the form of tape reproduction, would be be far less subject to these limitations. On the other hadd, being an exclusively aural medium, it is restricted to applications in which the absence of the moving, visual image is no significant handicap. A possible solution of live-distribution problems of television might be the videotape or kinescope recording, either for transmission over local facilities or for more intimate presentations to local groups of teachers via closed-circuit TV or 16-mm. film projection.

In all considerations of media, one of the oldest, the printed word, should not be neglected, particularly its most recent mutation, the programed text. Modern programing attempts to apply certain concepts of learning theory to the arrangement of learning material in such a way that the material itself teaches, and an individual may subject himself to it at his own convenience and pace. Are there areas of teacher education, particularly those involving the acquisition of foundational skills and knowledge, that lend themselves to this kind of organization?

One of the pioneering attempts in this direction has been B.F. Skinner's programing of a part of his course in psychology. To what extent may this approach individualize and perhaps intensify a future teacher's learning of elements of educational psychology, social foundations of education, or the subject matter that he is preparing to teach? Is the approach useful mainly as a part of existing university course conventions, or does it have possibilities for teaching, by itself, major segments of a teacher's foundational preparation? What are its possibilities for application to inservice programs intended to upgrade teachers already fully licensed, provisionally licensed, or of substandard prepration? Since in contrast to the sight-sound media, other than the language-exercise tape recording, programing requires continuing productive activity on the student part, to what extent is it better adapted to self-sufficient, autodidactic applications? And since, in its nonmachine applications, it is the most widely dispersible and individually controllable, as is any printed medium, to what extent may it be economically the most feasible of the new media? On the other hand, since the preparation of programs is a highly skilled, time-consuming task, to what extent can programs for the special uses of teacher education be justified on economic as well as professional and educational grounds? And most intriguing of all possibilities, to what extent can combinations of sight-sound media for initial presentation, and programed materials for individual followup exercises and review, be devised as multidimensional, new media packages for certain areas of teacher education?

It may indeed be that the most promising applications are in such combinations of media, particularly where they are expected to fulfill the major function of teaching any given area. Whether such combinations - with all their complexity, expense, and difficulty of production, control, dispersal, and evaluation - make a significant contribution to teacher education remains to be seen.

Part II. Media Research

Chapter V. Present Status of Media Research in Teacher Education

Questions asked in this and the following chapters are: (1) What is the present general status of media research in teacher education? (2) What are the prominent methodological characteristics of this research area? (3) What degree of conviction exists as to demonstrated or potential stability of the reported results? and (4) What degree of confirmation or contradiction exists within all media research with regard to proposed theoretical statements describing possible correspondence between functional characteristics and requirements of teacher education and functional properties of new media?

Scarcity and Recency

Rigorous empirical research with regard to applications of new media in teacher training is scarce, and existing studies are primarily recent. As a result, few replicated findings have accumulated as yet. The absence of replication and cross-validation of results is perhaps the most conspicuous characteristic of research on media use in teacher training.

The scarcity of empirical research is somewhat surprising in view of the considerable number of organizations which now have technical and professional resources. Recent publications (Campion and Kelley, 44;[1] Faris et al., 7[illegible]; Meierhenry and McBride, 176; Williams and Snyder, 276) describe formidable lists of institutions with various media facilities. It is not clear why so little systemati research has emerged from these many sources, but perhaps when expensive equipment is installed, prior to a demonstration of its value subsequent discussions tend to justify rather than to assess objectively.

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[1] Numbers are keyed to the reference in the last chapter.

Inherent Complexity of Functional Characteristics of Both the Teacher-Education Process and the New Media

Productive media research in teacher education must go further than a rudimentary study of the single medium as a separate instructional entity. Certainly, such research must consider the manner in which several media can be combined to produce a maximum impact upon learning. In this area of multimedia use, some complex problems instruction patterning have received little empirical study.

Media research must focus not only upon teaching methods and procedures but upon the nature and structure of subject matter and skills to be learned. The potential values of media used in preparing teachers to instruct children in a second language may be quite different from those used in training them to communicate the Archimedes Principle. Both applications, in turn, may be radically different from the way media find optimum use in training teachers to interpret nonverbal student communications accurately. Here again is a little-explored areaof complexity.

But the potential complexity of media research extends well beyond these problems of multimedia use and variations in application demanded by differing structural properties of subject-matter areas. In an earlier chapter, dependence of the teaching function upon desired educational objectives was outlined, as well as composition of the student group, skills, attitudes, personality, and methods (including media use) of the teacher, and major features of the learning environment. Interactions among these complex, multidimensional variables must all be viewed within the context of the ongoing, continuous learning process if one is to discover optimal combinations among these variables, within the instructional setting, which will maximize learning for particular students. If the ultimate aim of media research is to produce meaningful educational insights, a concentration upon the enormously intricate interactions among numerous instructional forces will be compulsory.

By listing selected components of these major instructional influences, one can indicate the scope of the research task of presenting an integrated picture of interactions among influences within the learning process. Variations have been noted among students in educational level, ability, maturation, level of aspiration, personality, and history of learning experiences; differences among teachers in objectives, personal relationships with students, knowledge of subject matter, teaching techniques, and their history of learning and teaching experiences; as well as the wide range of learning environments extending from such immediate forces as characteristics of student peers in the classroom to structure and impact of the adult community surrounding the school. To study the effects of an attempt to weave combinations of media experience into this intricate web of instructional forces, and then to study the operation of all these variables simultaneously is a monumental task.

Media research has responded to the inherent complexity of phenomena being studied in much the same manner as has past research on complex social and educational problems. Issues become atomized, divided for detailed analyses into small segments extracted from the general problems. Media studeis have avoided the complex problems of teaching and learning, focusing instead on research susceptible to study in the routine fashion of early investigations in psychology and education.

In the face of enormous complexity, this compartmentalization may be adaptive, but studies of small components can wander in many directions, with emphasis at any moment being determined by the most powerful or faddish public or scientific influences. Few efforts have been made to synthesize research evidence which accumulates in order to reconstruct the total complex matrix of instructional variables.

In common with much scientific research, media studies are beginning to face this traditional puzzle; How can a complex phenomenon be subjected to observation and analysis and retain sufficient inherent complexity without losing the meaning of the phenomenon in the analytic process

Lack of Systematic Theory

Despite several cogent efforts (Carpenter, 45, 46, 47; Fearing, 78; Finn, 83; Harckroad, 119; Hoban, 125; Meierhenry, 175; Miller, et al. 180; Norberg, 193 and Soege; amd Siegel, 235) to develop systematic theories of learning, perception, and communication to guide research, media studies still tend to be discrete, efforts unguided by theory which fail to contribut to a cumulative analysis of the role of media in the teacher-training process. The early history of interest in educational media strongly reflected an administrative orientation - the need to expose larger number of students to instructional personnel. With regard to teacher training, exploration of the use of new media was instigated by dual administrative needs of providing for instructional demands of inservice teachers through devices which can be used when a teacher is free from full-time teaching assignments, and of making available, as widely as possible, the services of the limited supply of teacher-education specialists.

This initial administrative orientation was far from meeting present needs for theory construction and data collection in media research. Until administrative concerns can be at least momentarily set aside, and attention can be given to the development of theoretical propositions which systematically and simultaneously encompass both the functional characteristics of teacher education and media operation, cohesive empirical information will emerge only sporadically.

The task of building a collection of empirical facts is, of course, the most compelling immediate problem in media researbh in teacher education. But while the additional accumulation and analyses of empirical data are necessary, the most crucial continuing taskswillbe to solve larger theoretical problems of combining small, discrete units of facts and propositions into systematically ordered knowledge, and at least to approximate the true complexity of the instructional process in this theoretical model. The problem of coordinating and synthesizing facts and propositions derived from diverse levels of media research will remmin a major unresolved task for some time to come.

Technique-Orientation

Research in new media usages in teacher education has been basically technique-oriented rather than problem-oriented. For this reason, media researchers begin examination of the educational utility of a particular set of instructional devices, and never depart from studying these tools even when the educational problem has been resolved or is deemed to be unsolvable. Gilbert (102, p. 565) states:

> While research is always in the business of testing techniques, when the techniques take precedence over problem, mush is lost. The questions of the greatest social interest are: How can neurosis be alleviated? How can arithmetic be efficiently taught? How can a schizophrenic be made normal? How can reading deficiencies be overcome?

To Gilbert's list of problem-oriented (rather than task-oriented) questions, the guiding inquiry of this monograph may be: How can teachers be trained more effectively? Although the attempt is to estimate the value of new media in teacher training, the methods do not supply the base of the inquiry. The instructional problem to be solved must be the essential focus, and yet media research has long suffered from excessive devotion to its tools rather than the problems to be solved, possibly, but not necessarily, by means of its tools.

Prevalence of "Nonsignificant Differences

Beyond the scarcity of theory-directed investigation, one recurrent problem of data interpretation aptly illustrates the inadequacy of media research at a theoretical level and the confusion introduced by a desire to draw immediate administrative conclusions - the problem of interpretation of the "nonsignificant difference" result which abounds in media research (Abel, 1; DeVault, Houston, and Boyd, 69; Fulton and Rupiper, 94, 95; Holmes, 127; Johnston, 138; Painter, 198, 199; Rogers, 211; Rumford, 215; Williams, 274). For example, significant differences are conspicuously absent in studies of student learning in courses taught with new media compared with those taught conventionally (Carpenter and Greenhill, 49, 50; and Macomber and Siegel, 161, 162). Also, these nonsignificant differences are not remedied dramatically when associated variables, which might be expected to condition the effectiveness of instructional media are introduced. As illustration, two-way communication between television reception (Carpenter and Greenhill, 49, 50); studying the attention level of students receiving televised instruction does not seem to help (Klapper, 145); varying the size of a viewing group does not seem to increase television effectiveness (McKeachie, 168); and adding supplementary visual aids to televised instruction seems equally fruitless (Carpenter and Greenhill, 49, 50;aand Klapper, 145). Not even looking the television viewer directly in the eye seems to make much differences(Westley and Mobius, 273). To date, the media research in teacher training has harvested a rich crop of statistically nonsignificant findings.

The weight of these nonsignificant differences gains magnitude when viewed against a common obstacle in drawing conclusions from research - the nonreported result. A general tendency exists to regard negative results as less interesting, illuminating, or worthy of publication than positive findings. Researchers often make no effort to publish nonsignificant results, and this may terminate in the appearance of a greater proportion of positive results on a particular topic than were actually obtained.

The general lack of motivation to report nonsignificant differences may be augmented in new media research by consequences of the fact that costly equipment often is installed before its utility has been confirmed. Nonsignificant differences discovered during experimentation may result in serious embarrassment, and with the equipment installed and in operation, media investigators would have difficulty in reversing their commitment and discontinuing or limiting use. Granting the existence of a general lack of interest in publishing negative results, and the special sources of embarrassment in media research, the heavy predominance of negative findings in reported studies is especially impressive.

The emergence of negative results can at times be almost as meaningful to research progress as a series of positive findings, if proper interpretations and explanations are sought conscientiously. But how have the recurrent nonsignificant differences been interpreted in media research? Generally, they are said to signify: (1) the equal effectiveness of devices compared; and (2) the fact that all media studied are effective instructional devices. The further illogical conclusion usually is drawn that, since inequality of effectiveness has not been experimentally observed, and equality presumably exists, decisions concerning media selection should be made on such extra-scientific criteria as administrative ease and economy. These misconceptions appear in prominent reviews (Allen, 5) of audiovisual research and are reflected in this statement by Norberg: (192, p. A-11).

> No dobut the force of the criticism of refundancy in television research arises from the sheer number of studies and the monotony of the ubiquitous finding, "no significant differences." From the sheer quantitative weight of such evidence it is argued that there can be no doubt of the fact that "television can teach." I would agree. The fact is there. It has been proved ....

Popham (204, p. 99) states the same misconception as follows:

> The lack of significant differences between the conventionally-taught and the tape-taught students in this study... allows the conclusion that the tape recorded lecture-approach...proved effective.

A final version of the misinterpretation of nonsignificant differences is offered by Hoban (126, p. 71). After indicating that the predominant finding in comparative effectiveness studies fails to distinguish the relative instructional value of different methods, he states:

> As far as a university facility is concerned, the reported findings (ad nauseum) on comparative effectiveness should be decisive. If research results were unique determinants of decisions on teaching methods of college and university instructors, these teachers would henceforth entusiastically welcome closed-circuit TV with open arms.

These statements are theoretical misinterpretations of the absence of media differences in effectiveness. It is logically indefinsible to interpret the failure to demonstrate conclusively that conditions are unequal as proof of their equality. Failure to reject the null hypothesis provides no positive evidence that all media are effective and equal in their impacts. If it were true that the usual classroom procedures (with which instructional media are often compared) represent the worst possible methods, what is gained by demonstrating a nonsignificant difference between these classroom methods and the use of instructional media?

Given the prevalence of negative results and the theoretical misinterpretations assigned to them, few empirical media studies have emerged that seem sufficiently exciting or illuminating to generate a progression of followup studies, starting with a replication of the original discovery.

Unstudied Processes

The trend to date in media research has been to perform comparative-effectiveness studies by measuring some initial status variable, introducing media experiences, measuring final status in order to assess change, and then comparing degrees of change among groups with different media experiences. These analyses of gross input-output changes ignore the intervening processes involved in interactions between learner and media material which result in the observed overall change. Although some audience response or feedback devices have been used in teacher education to provide a continuous record of student response to media, few studies attempt detailed, inside descriptions of the intervening processes of learning which may or may not be reflected in prepost change appraisal. Concentrated has been upon the overall gross effects, while ignoring what produces them in the mind of the learner.

Profusion of Testimonials

The literature on media use in teacher education is more often composed of testimonials for its use (Adkins, 3; Engbretson and Pendergraft, 74; Nardelli, 188; Rench, 208; Van Horn, 264; Weiss, 271; Wooley and Smith, 281) than reports of empirical evidence regarding its effectiveness. When criteria beyond the author's own impressions are applied, these are often the subjective impressions - or indirect testimonials - of students and teachers, (Follis, 91; Thompson, 257). An era of evangelical testimonials often appears in the early phases of a developing field of knowledge. Hopefully this era is passing in media research on teacher training.

Absence of Replication

The scarcity and recency of research, inherent complexity of the phenomena, lack of attention to developing systematic theory and to study of intervening processes, and the profusion of nonsignificant differences and testimonials - all contribut to the scarcity of replicated, established findings on the contribution of media usage to teacher education.

This absence of replicated information not only affects the degree of confidence to be placed in stability and reliability of media outcomes, but also indicates the paucity of data on the parameters of effectiveness of various single media or combinations thereof. Certainly it is clear that no single pattern in the use of new media will be identified as most effective under all conditions. The questions thus become those of exploring the various parameters of effectiveness: Under what sets of conditions does a particular medium or a specified combination of media produce discernible effects upon learning or performance? What sets of conditions maximize such effects or cause them to disappear? Establishment of such parameters describing gradations of impact upon a variety of learning variables of a variety of media combinations, each related to a specific learning objective, or set of objectives is, unfortunately, well beyond the current state of maturity of media research.

Issues related to the use of instructional media in teacher training are important and complex, but the absence of cumulative efforts, which build successively upon each other, permit few definitive empirical answers.

Organizational Characteristics of Media Research

Counterbalancing this unpleasant picture of the current status of media research in teacher education is the fact that several organizational advantages are operating to produce a potentially less-scattered accumulation of scientific work in this area than in many other newly emerging fields of research. While the research efforts in study of new media and teacher training are well distributed among universities and other organizations throughout the United States, many of these activities currently are sponsored by a single Federal agency, the Educational Media Branch of the U.S. Office of Education (under Title VII of the National Defense Education Act). Distribution of media research information also is centralized by the agency. In addition to the dissemination activities of the U.S. Office of Education, at least one professional journal (AV Communication Review) acts as a clearinghouse for media research studies by publishing supplements that summarize recent findings (Allen, 6, 7, 8, 9, 10; Bushnell, 40; MacLean, 160; Norberg, 192; Twyford, 261; VanderMeer, 262) in addition to its regular articles on media research. Furthermore, the AV Communication Review also presents collections of contributions emerging from conferences or group reports (Meierhenry, 175; Miller et al., 180; Norberg, 193). The profusion of scientific meetings hardly assures integration of research, but several valuable working conferences have been conducted by researchers to acquaint each other with current progress (e.g., Conference on Theory for the New Media in Education, Michigan State University, 1962; Conference on Educational Media Research in the Far East, International Christian University, Tokyo, 1962; National Conference on Teacher Education and New Media, University of Michigan, 1961; New Teaching Aids for the American Classroom, Stanford University, 1959; Teacher Education Directions for the Sixties, Bemidji State College, 1960; Television in Teacher Education, American Association of Colleges for Teacher Education, 1960).

Thus, the present general status of media research in teacher education does not provide dazzling illumination. There are signs, however, that cumulative progress may emerge from efforts to make this research more cohesive and comprehensive.

Chapter 6. Methodological Issues in Media Research

A primary determinant of the present unimpressive status of media studies in teacher education has been the failure to solve a host of methodological problems. Research on the role of media in teacher education inevitably falls heir to the methodological pitfalls and obstacles encountered in all attempts to analyze teaching and learning transactions (Gage, 96; McKeachie, 169; Medley and Mitzel, 197). The issues of research technique and experimental design discussed here are those particular forms of the broad methodological problems in research on teaching which have detracted most from progress in media research.

Definition and Measurement of Independent and Dependent Variables

Perhaps the most compelling methodological criticism of media research attacks the continued reliance upon experimental designs which ignore the multivariate complexity of both the instructional procedures and their potential outcomes. The early history of education experimentation (McCall, 167) is marked by "one-variable-at-a-time" research designs have been gradually incorporating multivariate assessments (Borko, 34; Cooley and Lohnes, 60; Gulliksen and Messick, 116; Harris, 121; Lindquist, Soar, 151; Soar, 244; Tomkins and Messick, 259), little use of multivariate analysis has been made in media research in teacher education. This gulf between the multivariate complexity of classroom instruction and the simplistic nature of media experimentation has blocked meaningful application of research knowledge to classroom practice.

The multidimensional character of the instructional process affects the selection and definition of both the dependent and independent variables in media research. Rarely is it realistic or meaningful to study a single isolated variable in assessing the effects of variations in media research - the criterion teaching behaviors - demand multivariate analyses. Similarly, the independent variables must be defined in multivariate terms. Fruitful media research in teacher education defines the experimental variations in teaching procedures within the total, ongoing instructional context and is thus unavoidably multidimensional in character. The necessary multidimensionality of dependent and independent variables in media research demands the application of multivariate experimental designs and procedures, and yet they are rarely applied.

The Criterion Problem: Defining and Measuring the Dependent Variables of Teacher Performance

Few educational topics have received as much attention as the problem of establishing teacher effectiveness and measuring change in teacher performance (American Educational Research Association, 12, 13; Anderson and Hunka, 14; Aschner, 17; Barr, 24; Barr et al., 23; Cornell, Lindvall, and Saupe, 61; Domas and Tiedeman, 71; Flanders, 87, 88; Hughes, 133, 134; Medley and Mitzel, 172, 173, 174; Remmers, 207; Ryans, 216; Schueler, Gold, and Mitzel, 224; Withall, 278). But we have not yet progressed beyond the controversy over whether any universally applicable criteria of good teaching can be located at all (Bantock, 21; Combs and Mitzel, 58; Martin, 163). In an research area, as criteria become increasingly well defined, success in locating meaninful scientific results is markedly improved. But Turner and Fattu (260 Preface) indicate the distance to be covered before the criterion problem in research on teaching methods can be clarified:

> Seventy years of research on teacher effectiveness have not added much to our systematic knowledge, and it is difficult to see how another seventy can do any more if the same procedures are followed. When every study must virtually start anew at the same place as its predecessor, little increase can be made in organized knowledge in the field.

Solution of the problems of defining and measuring criteria of teacher behavior continues to be delayed by the failure to apply systematically adequate taxonomies of essential elements of the teaching task. Comprehensive taxonomies of teaching performance facilitate research progress by providing a set of meaningful categories for the description of teaching and for specification of teacher-training requirements. Teaching behaviors and teacher-training requirements could, in turn, be logically and empirically matched with each other through research. Not only would a unified and generally accepted taxonomy of teaching facilitate the research solution of a criterion problem, but it would also permit more precise estimates of the applicability of research findings to an actual teaching situation. Several studies (Anderson, Brewer, and Reed, 15; Gage, 98; Medley and Mitzel, 174; Mitzel, 182; Ryans, 216; Smith, 240; Smith and Meux, 241; Stolurow, 262; Withall, 278) propose designations for major dimensions of teacher behavior, but these suggestions have found little application in media research.

Not only is an adequate taxonomy of teaching behavior lacking but also a useful taxonomy for children's learning in the classroom. There is clear agreement among educators (Anderson and Hunka, 14; Flanders, 87, 88; Hughes, 133, 134; Mitzel and Gross, 183) that the decisive criterion for effectiveness of a teaching method resides in the resultant learning by children in the classroom. While most research has concentrated upon defining changes in teacher behavior, it is generally recognized that the true impact of improving teacher-training procedures can be assessed only through the eventual outcome in children's learning. Several taxonomical schemes (Bloom 32; Melton, 177) have been offered for specifying definable changes in children's learning in response to variations in the instructional process. These efforts to establish a definitive terminology for categorizing changes in children's behavior have had little direct impact upon media research in teacher education.

Since the development and application of taxonomies of both teaching performance and children's classroom behavior have been neglected, it of course follows that sequential relationships among media use in training teachers, teacher effectiveness, and children's learning have not been established. The categories of teacher competencies described earlier will perhaps specify some of the classes of teacher behaviors to which teacher training through media use may contribute. Further bonds among media use, categories of teacher competencies, and children's classroom learning may then emerge.

Beyond the failure to employ adequately taxonomies of teaching and learning, further difficulties exist in attempts to designate and measure criterion teaching performance. Methodological questions specific to assessing teaching competence have been considered in detail elsewhere (Anderson and Hunka, 14; Bellack, 28; Medley and Mitzel, 172; Ryans, 216; Turner and Fattu, 260); and several cogent analyses (Fredericksen, 92; Wilson, 277) consider the broad problems of assessment of criterion performance in training areas other than teaching. For media studies of teacher education, it is important to recognize that teaching is an interactive process among individuals operating in a complex context and that there are many kinds of instructional effectiveness for different teachers, children, school programs, andclassroom situtations. It is also important to recall here the misleading effects for media research of attempting to circumvent complex criterion problems by using tertimonials and subjective impressions of students and teachers to assess teaching outcomes. These general conclusions point to two major needs: first, for criteria which objectively reflect the complex and continuously changing set of behaviors which constitute teaching performance; and second, for experimental designs (Campbell and Stanley, 43; Cooley and Lohnes, 60; Medley and Mitzel, 172; Schutz, Page, and Stanley, 225) which can adequately encompass such adequate criteria.

Experimental Teacher-Training Methods: Defining and Establishing the Independent Variables of Media Conditions

When teaching methods are defined precisely and in detail, with the intention of making comparisons among them, differences, among the methods on several diverse dimensions almost always become apparent. Two extreme positions exist on the correct approach to the multidimensionality of differences among experimental media treatments. Some researchers are convinced that it is only the integrated sum of the several dimensions within a teaching method that provides meaningful empirical findings, and they seek experimental designs that will access this multidimensional analyses. This position has been advocated in the earlier pages of this monograph.

The opposing position states that comparing the conglomerates of variables which compose each media treatment prevents the research from assigning any discernible outcome to specific dimensions within the overall experimental treatment, and sacrifices clarity and precision in order to retain naturalness or power. Thus, McKeachie (169, p. 64) says:

> You may feel that it is only the sum of [a number of variables which differentiate teaching methods] which really makes a difference. Nevertheless, don't go ahead with a global experiment lightly. Sometimes you can get much clearer results by taking one variable and studying its effect in a small experiment than by a big experiment including the kitchen sink.

Another issue among researchers with regard to the media experiences to be used in teacher training is reflected in a difference of opinion bwteen the authors of this monograph. Schueler has argued strongly (Schueler, Gold, and Mitzel, 224) that the media experiences must constitute spontaneous, "slice of life" episodes which retain the authenticity of uncontrived observations. In contrast, Lesser has argued (Sholler and Lesser, 250) that some degree of artificiality is automatically introduced when an image is filtered through any form of media machinery, and that one should capitalize upon opportunities to carefully precribe and structure media experiences to which teachers-in-training are exposed. Ture fitting of the media experience and the teaching objectives can thus be attempted.

At least two clear forms of resolution of this difference exist. One suggests that each approach has its special advantages and disadvantages which must be judged in the light of the instructional objectives. The other suggests that both spontaneous and structured approaches be used in combination, again depending on the educational purposes. It is nonetheless clear that differences among researchers exist on several issues regarding the setting of experimental media conditions. Among other questions, these include issues of complexity v simplicity, and spontaneity v structuring of media conditions.

However, considerable agreement exists regarding other facets of defining and establishing independent variables representing media conditions. For example, in teacher education, greater care is being devoted to defining and introducing experimental contingencies and to providing full and precise descriptions of experimental and control conditions. It is now clear that carefully prescribed experimental conditions and attention to detail are necessary to yield productive results in media research. Of great benefit in designing and interpreting media research (Stoller and Lesser, 250) is the attempt to build the definition and introduction of experimental conditions upon a set of theoretical or logical propositions which dimensionalize the independent variable and propose logical relationships between media conditions and their potential outcomes. This approach provides some contrast to earlier media research in which films and other media materials were introduced for study in just the form in which they had been created for other, earlier purposes. Careful construction of media conditions based upon theoretical analyses of teaching and learning is generally recognized as valuable in media research, although this recognition has not as yet gained wide currency in application.

Another area of agreement among researchers concerns the need to integrate media conditions into the total instructional context, including characteristics of the subject matter, teacher, students, and learning environment. Clearly it has been inefficient and confusing during the early history of media research to thrust some new media approach into an old syllabus or curriculum without concurrent reconsideration of the whole curriculum itself. New syntheses must be achieved in which considerable attention is given to revising the entire outline or structure of the syllabus or course in order to reap the greatest benefit from introducing media instruction. The earlier failure to consider media experiences in context is perhaps attributable in part to reliance upon experimental designs which used conventional classroom conditions for control comparisons. These designs simply compared conventional courses with and without media. However, in recent media research, definitions of independent variables which ignore the total learning and teaching context are slowly disappearing.

A third area of agreement among media researchers concerns the need for close collaboration among educator, researcher, and technical production staff. The educator and researcher (hopefully he is often the same person) state the educational objectives and instructional points to be made, determine how the media material is to be used, and structure the educational situation in which such media are to operate. The production staff knows the capabilities and limitations of media equipment and the techniques for illustrating educational material visually.

Too often in the past, production personnel were not fully informed, even about such basic matters as educational objectives of the lesson, and with equal frequency, the educator was vague about the techniques of production necessary to achieve that objective. Not only must educators, researchers, and productive staff recognize the need for continuous communication, but they also must realize the huge communication gap that exists among them. Educators often have taken for granted too much awareness of the educational objectives and have not communicated fully with the production staff rather than risk offending producers with long, detailed explanations of what an educator regards as obvious. Conversely, production staff often protect their own status and interests by pretending that matters of technique are accessible only to those initiated into the mystique of production rites. Now greater recognition is being made of the need to coordinate education and production and to improve techniques for achieving such coordination.

Thus, areas of both agreement and disagreement are being found among researchers with regard to establishing experimental conditions. Differences exist on such matters as the degressof complexity or simplicity to be contained in media experiences and spontaneity or structuring of episodes depicted. However, there is increasing agreement that the independent variables in media research must be prescribed logically and explicityly reported, that decisions about media use must be made in the light of total instructional context, and that close coordination among educators, researchers, and production personnel, is highly desirable.

Establishing Logical Linkages Between Dependent and Independent Variables

The earlier analysis of the functional characteristics of teaching led to a delimination of several component aspects of teacher performance which may be viewed as aims of the teacher-training process. Desirable competencies included the ability to develop and analyze teaching goals; knowledge of subject matter and the requisite skills necessary to its communication; and knowledge of student characteristics, the learning environment, and relevant aspects of the teacher's own characteristics. These features of the teacher's role were described earlier in some detail, and they represent on statement of the goals or "job analysis" of ingredients of the teaching performance which teacher training attempts to induce.

This job analysis of the teaching function was generated in earlier chapters of this monograph by a logical analysis of teaching goals and processes. An alternative or supplementary strategy in specifying criterion teaching behaviors would be generated empirically, starting with the observed connections between salient characteristics of school children and teaching performance. In the first step of this empirical approach, the development of children is viewed as composing a set of dependent variables which teacher behaviors constitute the independent variables which influence how well children learn what we want them to absorb. Having empirically distinguished the relative effectiveness of various teacher behaviors in inducing learning, this approach regards effective teacher behaviors as dependent variables to be affected by independent variables of teacher-training methods and course content. Thus, this empirical process first regards teacher behaviors as independent variables affecting children's learning, and then regards the effective teacher behaviors so identified as dependent variables to be induced by teacher education programs. These steps, starting with the observed classroom behavior of children, constitute an empirical complement to the logical derivation of desired teacher competencies.

After a specification of the teaching task has been derived from theory or empircal research, and has generated a useful set of criterion behaviors, the researcher must select the teaching characteristics or combination of characteristics to be developed, discover what units of information of skill the teacher-in-training already possesses, and then formulate a logical and feasible plan for progressing (In part through media instruction), from the student's present status to the desired outcome. This conceptual plan must then be translated effectively into production and evaluation of the media material.

This overall process is simple and perhaps self-evident, but it describes what is often lacking in media research in teacher education - a conceptual analysis of the logical linkages between educational objectives and experimental teaching conditions. Educational objectives determine the selection of criteria of teaching proficiency, and these in turn,should shape media procedures constructed to produce these competencies. If, for example, the education objective in teacher training is to create subject-matter mastery, and the independent variables contained in programmed instruction techniques are expected, on logical grounds to contribute to this aspect of teacher competence, then the empirical study of this particularl relationship between dependent and idenpendent variables is dictated. If, by contrast, the educational effort is to foster the ability to critcially analyze and assess observed teaching behaviors as a step toward actual teaching proficiency, then the instructional use of prepared films or kinescopes is logically linked to this goal (Stoller and Lesser, 250) and should perhaps be selected as independent variables.

However, when we speak of training teachers, ordinarily we do not refer to any single set of competencies such as subject-matter mastery or critical appraisal ability. In training teachers we usually designate a matrix of several interacting competencies as the aim. Nor do we ordinarily mean by teacher training merely the student's ability to verbalize a knowledge of the several component competencies. The bridging of dependent and independdnt variables in media research often depends upon an explicit demonstration that the student can apply a verbalized knowledge in an actual teaching situation. Unless performance or utilization criteria are used, the logical linkage between independent variables of media capabilities and criterion outcomes cannot be fully assessed.

Closely related to the distinction between verbalized knowledge and performance criteria is the issue of correspondence between training and testing devices. Media presentations normally stree pcitorial and verbal modes of presentation. Some learning outcomes are tested through a combination of pictorial, verbal, and written modes (an actual teaching performance accompanied by a prepared lesson plan), but testing has most often been done by means of written examinations. In bridging dependent and independent variables, the differences and similarities between modes of presentation must be considered (Holmes, 127).

Another issue in logically bridging dependent and independent variables in media research focuses upon differences between immediate and long-term effects of teacher-training experiences. Several studies (Bach, 18; Seagoe, 226) illustrate the problem of establishing relationships between practice-teaching ability and later success in the field. Choosing media conditions which can be expected to improve the immediate preservice competence of a student teacher may not be suitable if the goal is to produce long-term effects which will be reflected in the teacher's inservice performance. Thus, a researcher must decids upon the expected duration of the instructional impact in order to establish logical connections between training and testing variables in media research.

Media research has too long been dependent upon haphazard administrative determinants in selecting dependent and independent variables for study. Educators are just beginning to profit from the careful definition of learning criteria and experimental conditions and from building logical, conceptual bridges to connect variables. These conceptual systems must consider such issues as verbalized knowledge compared with performance skill, the degree of correspondence between modes of presenting training compared with testing conditions, and the expected duration of learning effects of media instruction. As these conceptual developments progress, an increased cumulative understanding of the role of media in teacher education can be anticipated.

Sample Selection

Obtaining Unbiased Samples

Administrative pressures and the policy that only volunteers should be used in instructional experimentation are serious sources of sampling bias in media research. In teacher education programs, the restrictions on course schedules and section assignments make it difficult to avoid self-selection by the subjects. Also, the policy of permitting voluntary decisions by the individual student as to participation in media experimentation can immobilize media research in teacher education. The extreme instances in which volunteers are assigned to experimental treatments and nonvolunteers to control groups are obviously disqualified as valid research on the ground of selection bias.

Another aspect of self-selection bias in media research concerns the unrepresentative nature of institutions which conduct media studies. Organizations initiating media research are most likely to differ on several dimensions from those which either ignore or refuse to conduct such research. Institutions which seek opportunities to conduct media experimentation perhaps have more interest and motivation, less fear of inspection, and greater willingness to adapt administrative routines in order to achieve some potential improvement in educational practice. Not all institutions can afford the equipment and personnel to conduct such research. The media effects found in such selective settings may apply specifically to these settings and possess little information upon which to base general conclusions. Since our ultimate aim is to apply educational techniques with demonstrated effectiveness, serious questions arise regarding the transfer of methods developed in selective institutions to an unselected target population of schools.

Biased sampling invalidates media research, and yet certain institutional circumstances hamper the unbiased assignment of subjects to experimental treatments. Of special importance, therefore, is the use of the most effective sampling procedures that administrative circumstances allow. These procedures that administrative circumstances allow. These procedures include several approaches to the random assignment of subjects, the equating of individuals or groups, and statistical covariance control.

The complexity of the instructional process studied in media research reflects an almost immeasurable number of potentially uncontrolled influences upon experimental findings. Under such complex conditions, randomization techniques provide basic protection against the systematic operation of these uncontrolled sources of influence, but little doubt can exist that even available randomization procedures have not been fully exploited in media research in teacher education. This defect usually is ascribed to administrative requirements. However, these practical restrictions upon randomization can often be circumvented or reduced if administrators and researchers cooperate in finding compromises. For example, certain minor administrative adjustments allowed Stoller and Lesser (250) to assign individual college students at random to course sections and then to assign these course sections at random to experimental treatments and instructors. Improved application of randomization is basic to progress in media research the initial step being to find new ways of coordinating the demands of randomization with administrative requirements.

When viewed as supplements rather than substitutes for randomization, both the matching of individuals or groups and covariance techniques can increase experimental sensitivity in media studies. In the traditional and standard experimental design, which compares the experimental and control group on pretest-posttest change scores, matching can be a valuable adjunct to randomization but not its substitute. The total sample available for study can be organized into matched pairs of subjects, and then members of these pairs can be assigned at random to experimental treatments. If the S's are successfully matched for variables which would otherwise obscure the effects of experimental treatments, equating followed by randomization will produce an experimental design with greater precision than would randomization alone. Successful matching will reduce the size of differences between experimental and control groups on the dependent variable that would occur by chance alone, or through the operation of extraneous influences.

The potential value of equating individuals before random assignment is often outweighed by difficulties in obtaining adequate matching. First, it is often difficult in media research to identify in advance those variables which are most likely to obscure experimental effects. When several variables are isolated as equally good candidates for matching purposes, choosing among them may be amatter of subjective judgment; and yet matching individuals on more than two or three factors is rarely feasible. Second, considerable effort must be given to obtaining reliable, valid, and precise measures of variables used for matching. Since few established measures are available, the researcher ordinarily is forced to spend considerable time in constructing them. Third, if matching on several factors is to be precise, a large number of cases must be available from which to select. All cases must be measured on the matchigg variables, but considerable loss of cases may occur in order to obtain precise matching on more than a single variable. Fourth, statisticians question any matching procedure that result in losing subjects because such a procedure that results in losing subjects because such a procedure may drastically change the sampling process and introduce bias.

Thus, matching usually can control the extraneous effects of only a few variables, and often can make heavy demands upon the experimenter. A tenacious trandition in educational research has been to rely upon matching as an appropriate and sufficient condition for establishing the preexperimental equivalence of groups and to neglect basic randomization techniques. While selectively applied matching may provide a useful supplement to the basic randomization procedures, matching without randomization will not be sufficient for most experimental purposes.

In contrast to the relatively limited value of matching in media research convariance techniques are likely to play an increasingly important role in solving problems of sample selection. In media research, one must often accept conditions which severely restrict the operation of randomization. The most important instance is that in which intact groups must be used if the research is to be conducted at all. These intact groups usually represent classes of college students, or in some instances, difference schools represent the subpopulations. Reorganization of classes or schools for experimental purposes often is not administratively feasible. In these cases, the intact classes or schools may be randomly assigned to various experimental treatments, but this does not provide as much protection against extraneous influences as the random assignment of individuals to groups.

When individual S's cannot be randomly assigned to groups, but intact classes must be used, matching of classes obviously is inappropriate. Matching cannot provide the necessary equation of experimental and control classes; indeed it creates undesirable regression effects. Greenhill (107), Stanley and Dorman (246), and others have analyzed the problems of using intact classes. Lindquist (191, p. 172-339) offers several designs, including the analysis of covariance, which compensate for initial differences between experimental and control groups and permit the statistical control of concomitant variables which might obscure experimental differences. Lord (153) has cautioned against the use of analysis of covariance when the covariate is unreliable, but because media research often must use groups which are already in existence, covariance analysis will be an extremely valuable tool. Again, covariance should not be viewed as a substitute for randomization, but rather as a useful supplement for increasing the sensitivity of experimental comparisons.

When the appropriate combination of randomization, matching, and coveriance techniques cannot be exploited, several types of "quasi-experimental" designs have been suggested (Campbell and Stanley, 43; Schutz, Page and Stanley, 225). However, there is little doubt that media research would benefit greatly from more judicious and careful use of randomization, equating, and coveriance to obtain unbiased samples of subjects, and to assess and offset inevitable biases in sampling.

Establishing Suitable Control Groups

Assigning teachers to experimental and control groups - in media research as in all other experimentation, control groups are used to detect the degree to which extraneous variables (such as practice effects, natural changes over time, participation in an experiment) produce the changes in learning which one wishes to atbribute to the teaching method. Since it is clearly meaningless to completely confound differences in media conditions with differencew in teacher characteristics, few studies continue to assign different teachers to use different media of instruction. A common solution has been to assign several teachers to use each of the media conditions studied, but this solution poses its own dilemmas. Aside from the difficulties encountered in persuading teachers that such experimental conditions are sensible, most teachers understandably find it an enormous and sometimes hopeless effort to teach the same subject matter by several methods. Often the methods lose their distinctive characteristics as the teacher applies what appears to be the most powerful approaches without regard to special capabilities of the particular media under study. By contrast, other teachers over-conscientiously employ artificial constraints to maintain or accentuate experimental differences (McKeachie, 169). Or, since teachers inevitably have preferences among experimental conditions, intrateacher preference differences become fully confounded with experimental conditions. In any of these cases, even when the effects of teacher personality are permuted among experimental treatments, the intended comparison among media conditions may lose clarity.

Using "traditional" teaching procedures in control groups - Researchers have often chosen to compare experimental teaching procedures with control conditions represented by classes which continue to be taught by "traditional" methods. This choice of control comparison often is dictated by the motivation to find a better teaching procedure than the one in current use. When an objective is posed in this limited manner, the comparison of new procedures with old patterns becomes almost automatic and unquestioned.

However, unexpected difficulties are encountered when attempts are made to maintain a customary teaching pattern as part of a program of experimentation. Under the scrutiny demanded by the definition and exact description of experimental conditions, tranditional procedures are often found to be so deficient that researchers question the value of comparing any modified conditions with these mindless customary techniques.

But beyond the problems of maintaining customary patterns within an experimental effort, the choice of intact traditional procedures as control ignores the fundamental value of control comparisons. Control groups must differ from experimental groups in ways dictated by the independent variables studied, and must not differ systematically in other ways which may affect the results. It is unrealistic to assume that each of the necessary differences and similarities between experimental and control groups will be obtained automatically by the use of control classes following "traditional" patterns.

Absence of "zero" groups in media research. - The customary reliance upon traditional or conventional procedures to supply control comparisons has hindered the utilization of other baselines for comparison. Notably absent has been the "zero" control group - none which would supply information concerning degree of student progress in the total absence of instruction. For example, Stoller and Lesser (250) compared the relative effectiveness of three observational approaches (kinescopes, television, and direct observation in the classroom) upon the learning of information concerning methods of teaching and the ability to analyze critically and evaluate classroom lessons. But were any or all of the forms of observation superior to no observation atall? Perhaps the major question does not concern distinctions in effectiveness among observational techniques (some using new media and others not), but asks whether there is a distinguishable difference between some observation and none. While questions of this nature are perhaps the most crucial in the analysis of teacher training, it is not often administratively permissible to use a zero group or control sample which receives no instruction in any form. Thus, in the Stoller and Lesser (250) study, as well as in any form. Thus, in the Stoller and Lesser (250) study, as well as in other media studies, no baseline is available to represent the gain in learning in the absence of any formal observation.

The "zero" baselines is not always appropriate, but it rarely appears even when the question is raised of whether or not any form of professional preparation (with or without the new media) makes a difference (Beery, 26; Hall, 118). In these instances, a "zero" group is demanded by the form of the question.

Control of Extraneous Variables

Since all forms of control groups are designed to extract the influence of extraneous variables affecting changes in dependent variables which we wish to attribute to independent variables, the several classes of extraneous influences which are prominent in media research will be enumerated next. Many sources of contamination exist in educational experimentation. Those listed here are the variables appearing conspicuously in media research in teacher education, which could produce changes that are mistaken for the results of independent variables.

Student Motivation

Teacher in training will behave to some extent as expected; if they believe that the instructor or researcher is attempting to explore or establish new instructional possibilities, they are likely to cooperate by giving their interpretation of what is wanted.

Student motivation may affect media research in another way - a desire for good grades may be so strong that any differential effects of instructional procedures will be masked (McKeachie, 170). Grades often become so important that students may compensate for ineffective teaching by additional study. Thus, real differences among instructional procedures may be submerged, and the results of ineffective instruction may be misinterpreted.

Instructor Motivation and Ability

For many media studies, instructors volunteer to participate in an experiment because they are personally involved or committed to a particular outcome. Or if instructors are solicited to participate, those who accept are likely to be more interested and motivated, or less concerned about exposure to scrutiny. Their classroom behavior may, of course, be strongly influenced by their own desires or preconceptions.

Thus, new methods ordinarily are tested by an instructor who views them with enthusiasm. Although earlier discussions concerned the values and limitations of offsetting differences in teacher motivation and ability by assigning several teachers to use each experimentalcondition studied, the problem still remains of comparing effects of a new method used by an entusiactic or adept instructor with an old method used by an unenthusiastic or inferior instructor, even when the same instructor teaches by both methods.

The importance of differences in instructor motivation and ability appears in numerous studies. Thompson (257), for example, found that student attitudes toward media instruction were more directly related to instructor differences than to differences in observational techniques. Schueler, Gold, and Mitzel (224) report that change during student teaching is more closely related to characteristics of the student's cooperating teacher than to supervisory techniques used. Instructor motivation is a significant influcene which demands careful control when it does not provide, in itself, the substantive focus.

Viewed from another scientific perspective, the effects of these differences in instructor motivation and ability become self-evident. Social psychological research (Hovland, 131) has established the crucial importance of prestige to the communicator. Students most often regard instructors as reliable sources of information, and will of course respond to instructor differences in motivation and commitment to various instructional procedures. The effects of instructor prestige and the instructional method used must be appraised separately.

It is impossible to estimate the number of innovations in teaching methods which have flowered briefly and then faded as the innovator's enthusiasm waned or as new staff members replaced the original innovators. Instructor differences in motivation and ability must be scrutinized carefully.

Experimenter or Observer Bias

In discussing the extraneous contributions of student and instructor motivation, we mentioned that the expectations of an experimenter can significantly effect response. Expectations of the experimenter also may operate to distort his observation of the subject's behavior. Thus, experimental bias may consciously or (more often) unconsciously operate so that the act of observation both changes the phenomenon being observed and distorts the observation (Rosenthal, 212).

Although the experimenter's bias most often functions without his awareness, an illustration indicates the manner in which observer bias may influence experimental findings directly and explicityly. In the attempt by Schueler, Gold, and Mitzel (224) to improve student teaching by providing both supervisor and student teacher with a kinescoped record of practice teaching sessions, pre- and post-measures of teaching behavior were obtained from kinescope-film observations at the beginning and end of the semester. Evaluations of these pre- and post-training records were made by mixing all kinescopes so that judges could not identify and be influenced by pre- and post-records. However, because the student teachers and children wore different types of clothing at the two differenct times of the year, distinctions between pre- and post-training films were almost forced upon the judges. There is little way of knowing the degree to which this source of observer bias distorted the judgments made.

It is also apparent in media research that the phenomenon being observed is being changed by the use of the medium itwelf. For example, in the Schueler, Gold, and Mitzel (224) study, little doubt exists that considerable anxiety was created by the act of performing before television cameras, resulting in strongly modified behavior.

Instrument Decay

"Instrument decay" (Campbell, 42) refers to autonomous changes in the measuring instrument itself during repeated applications. For example, if examinations are used as criterion measures, grading standards may shift from the beginning of an experimental period to the end. Or, if classroom participation is being observed, the observers may become more skilled or more bored on later occasions than earlier. These sources of contamination also suggest that evaluations be made without knowledge of whether the measure is pre- or post-test. However, as in the Schueler, Gold, and Mitzel (224) study, this procedure is sometimes difficult to implement.

Effects of Testing

Taking a test at the beginning of an experiment may affect the scores of a subsequent testing or the degree of sensitivity or responsiveness to experimental conditions. Thus, a reactive effect of pretesting can be expected whenever the testing process is itself a stimulus to change rather than a passive record of behavior. For example, in the Schueler, Gold, and Mitzel (224) study, placing observers or television cameras in a classroom to observe the student teacher's pretraining teaching skills may in itself change teacher behavior. In general, the more novel or motivating the testing device, the more reactive it will be.

Hawthorne or Novelty Effects

It has long been known that, if an individual is aware that he is participating in an experiment, this knowledge will alter his performance. The Hawthorne Effect refers to any experimental situation in which the mere fact that the subject is participating in the experiment or receiving special attention will modify his behavior. A prominent source of counterfeit findings in media research is the student's knowledge that he is participating in an experiment.

> For human experimental subjects, a higher-order problem-solving task is generated/[by participation in an experiment]/ in which the procedures and experimental treatment are reacted to not only for their simple stimulus values, but also for their roles as clues in divining the experimenter's intent. The play-acting, out-guessing, up-for-inspection, I'm-a-guinea-pig, or whatever attitudes so generated are unrepresentative of the school setting ... seriously hampering generalization. (Campbell and Stanley, 43, p. 190).

Reactions will, of course, differ when students are asked or forced to participate in situations in which new or unusual methods are used experimentally. The newness may add excitement and enthusiasm, or, at the other extreme, resistance or hostility. When student participants in a new method know that they are competing in examinations with students taught by traditional methods, they may become particularly outraged. It is difficult to assess these reactions directly and to determine their impact upon experimental outcomes.

Another variation in student response to participation in a media experiment is the relief that students may feel in escaping from some degree of direct control by the teacher and the usual college classroom routines.

Hawthorne or novelty effects preclude generalization concerning the impact of experimental variables upon subjects exposed to them in nonexperimental settings. Suggestions for redcuing Hawthorne effects include disguising purposes of the experiment from the student (and even, when possible, from the instructor), and adequate attention to randomization in assigning individuals to groups and groups to experimental treatments. But since no definitive techniques exist for controlling Hawthorne effects, accepting and applying the results of media research in teacher education must be done with caution.

Procedural Irregularities

Procedural irregularities and unexpected difficulties appear to be trivial sources of error, but they are a special cause of constemation in media research. What do you do with a group when the film projector breaks down or when a visit to a school must be postponed because of weather?

Since media research usually extends over a longer period than a single session, lost cases and subjects for whom only partial data are available become troublesome irregularities. This can result in a subtle sampling bias because these aprtially or fully lost cases may not represent a random sample of the participating groups. No adequate rules have yet been established for dealing with this problem.

Halo Effects

Halo effects - the tendency, in estimating one characteristic of a subject to be influenced by other characteristics - produce serious distortions in media research, especially for measures of teaching proficiency. Again, numerous suggestions have been made to reduce halo effects (Medley and Mitzel, 172). These suggestions focus mainly upon improving the clarity in selection, construction, and application of behavior items used in the estimates of proficiency. However, halo effects undoubtedly persist in plaguing teacher education research.

Leniency Effects

Closely related to halo effects are leniency effects, which refer to the tendency to judge others high in favorable traits and low in unfavorable traits (Bruner and Tagiuri, 37). Since teaching competency is viewed by judges as the favorable or valued ideal, the leniency effect often will produce a piling up of judgments at the "good" end, reducing discriminations available among subjects.

Certain salient methodological obstacles to productive media research in teacher education have been enumerated: problems of defining and measuring media conditions and their effects on teaching proficiency, obtaining unbiased samples, establishing suitable control groups, and controlling extraneous sources of influence. Other problems are common to all educational experimentation, including the design of instructional media research. Since these problems have been discussed comprehensively elsewhere (Campbell and Stanley, 43; Lumsdaine, 156; Lumsdaine and Roshal, 158; May and Lumsdaine, 166; Medley and Mitzel, 172; Mosteller and Bush, 186), only illustrative topics will be enumerated: the use of change or gain scores (Harris, 121); "ceiling" and "floor" effects in measuring change; regression effects; establishing the proper form of reliability and validity of measures; the sampling of materials or subject matter representing independent variables; replication of experiments; the logic of interpreting results which fail to reject the null hypothesis; and establihhing standards for determining sensitivity of experiments.

In the face of these numerous and serious methodological problems, it is fortunate that several recent advances offer important constructive recommendations. Of special value at the current stage of media research in teacher education is the comprehensive specification and systematization of educational research presented in the compendium of research on instruction compiled by Gage (96). This exhaustive coverage provides a broad perspective of theory, methodology, and substantive findings in the manifold aspects of research on the teaching and learning process. The frequency with which references have been made to this handbook in the present bulletin attests to the broad perspective it provides for inquiries of the present type.

Also, progress has been made (Bock, 33; Fiske and Rice, 84; Holtzman, 129; Lord, 152; Webster and Bereiter, 269) in developing methodologies to obtain and analyze repeated measures or observations through time on the single individual in order to study detailed, step-by-step process changes in learning. Already referred to are the emphasis upon overall prepost change in media research and the scarcity of studies which examine the continuous sequential course of individual learning, which is only grossly and inadequately reflected in overall change measures. Techniques which provide intensive, intra-individual trend analyses or time-series patterns of learning will be of enormous value in media research in yielding more detailed understanding of how instructional media produce sequential, incremental effects upon learning.

The recent proposals for quasi-experimental designs offered by Campbell and Stanley (43) and Schutz, Page, and Stanley (225) will also have addirect impact upon the methodological problems encountered in media research. Many of the problems described in this chapter could be reduced or circumvented by consideration of these quasi-exerpimental designs which recognize the severe limitations connected with conducting regorous research on instructional processes, and provide constructive design resources to be used when pratical limitations prevent the full use of conventional research procedures. Campbell and Stanley (43) offer alternative quasi-experimental designs which recognize explicitly that optimal control may be lacking, but produce meaningful empirical results even in the face of severe practical limitations of the kind normally found in schools. Schutz, Page, and Stanley (225) have elaborated the quasi-experimental models specifically for educational media research. Quasi-experimental designs may be used in the following areas: (1) in fields of study which are not yet ready for experimental rigor, (2) where practical conditions do not allow full or sufficient control, (3) where the number and magnitude of extraneous variables is great, (4) where randomization techniques cannot be fully exercised, and (5) where the number of plausible rival hypotheses to the hypothesis being tested in extensive. Since these are precisely the conditions under which much media research in teacher education operates, the applicability and value of these new quasi-experimental designs are impressive.

Chapter 7. Research Evidence on the Role of New Media in Teacher Education

The analysis of the teaching function (presented in chapters 1 and 2 of this bulletin) led to the specification of a set of adequate teacher competencies required to instruct. The delimitation of these teacher competencies led in turn (in chapters 3 and 4) to the definition of a set of media resources and experiences which might contribute to such teacher competencies. The present chapter surveys existing research results in order to estimate the demonstrated power of media instruction in improving teaching proficiency. What evidence is there that the use of new media will result in more effective learning of the several teacher competencies that are basic to the teaching function?

Although the assessment of a body of research evidence appears to be objective, several judgmental issues are involved. The reported levels of statistical significance of experimental results provide a base for assessing whether media effects are great enough (in relation to variability in subject performance associated with imperfect reliability of measuring instruments), not bo be attributed to chance variations. But levels of statistical significance are only a necessary but not sufficient basis for summarizing research literature.

Exppriments differ in sensitivity, precision, and freedom from methodological errors. Independent variables of great inherent power may yield findings of no statistical significance because of insensitivity of the test used to assess outcomes. Conversely, independent variables of little power may yield highly significant results statistically because of the use of a refined and sensitive methodology. Thus, the assessment of a body of research evidence demands judgment of the power of variables relative to the sensitivity of the test of their effectiveness. Levels of statistical significance do not provide a fully adequate index of this comparison.

Exerpiments also differ in the degree of generality of findings across a variety of learning and teaching conditions. Media research has long suffered from the selection of media materials and instruments on the basis of purely local administrative considerations. For example, many studies measuring the effects of a particular film or set of films have been erroneously generalized to all films as media instruments. Evaluative studies in which permissible conclusions are limited to a single film or set of films often are presented as if they documented the capabilities of films in general. Thus, another judgmental matter in assessing a body of research literature is to assign accurately appropriate degrees of generality to the reported results.

Experiments differ further in the stability of their findings. One replicated findingsmay carry the same interpretive weight as numerous studies which report statistically significant but unreplicated results. Indicated earlier was the fact that a distinguishing feature of media research is the absence of replicated findings, but the criterion of stability is a crucial determinant in judging the true impact of experimental conditions.

Thus, differences among experiments in sensitivity, generality, and stability - all introduce judgmental elements in the survey of literature on the role of new media in teacher education. It is obvious that any number of poorly designed studies yielding negative results of restricted generality will be outweighed by one well-designed, precise study yielding positive results of broad generality. Somewhat less apparent is the fact that any number of poorly controlled studies, even when they generate positive results, will be outweighed by a truly rigorous, sensitive experiment which nonetheless produces non significant results.

Other judgmental factors are interjected into a research survey by the administrative need to balance educational costs and payoff. An instructional approach of limited cost (in expense, equipment, maintenance, and personnel demands) may be more justified despite its restricted yield than a more costly arrangement. The comparative costs of several instructional procedures have been analyzed (Carpenter and Greenhill, 50; Nelson, 191; Seibert, 228). In an applied area such as teacher education, the research must be reviewed with both hypothesis-testing and potential implementation in mind, and the balance between costs and payoff becomes an important consideration.

In the light of these many subjective judgments which intrude into a research survey, no highly detailed or refined evaluations will be offered for each of the individual studies reviewed. It will, however, be clear that all studies are not given equal weight; indeed, some relevant studies will not be included because of obvious defects. Other studies may not be used because only a small proportion of media studies in teacher education have appeared in the published literature, and unpublished research and mimeographed copies were not always available. Also excluded from coverage are subjective testimonials to the utility of media in teacher education (Nardelli, 188; Rench, 208; Weiss, 271); studies of attitudes toward media (Dreher and Beatty, 72; Erickson and Chausow, 75; Evans et al., 76; Follis, 91; Hardaway, Beymer, and Engbretson, 220; Holmes, 128; Loubriel, 154; Ramsey, 206; Thompson, 257; Westlgy and Jacobson, 272); and research which does not bear directly upon the teacher education process. Also ignored are studies (Baker and Schutz 20; Florida State Department of Education, 90; Glasgow, 104; Oliver, 197; Ramsey, 206; Wittlich, 279) concerned with teaching students to utilize audiovisual technology.

In assessing the degree to which available research findings confirm or contradict theoretical propositions (developed in the earlier chapters of this bulletin) concerning the role of new media in teaching function, studies will be surveyed under the following general headings. Categories described the new media as a means of:

1. providing more efficient observation of classroom behavior for teacher education.
2. Providing more efficient self-instruction and supervised practice experiences for teacher education.
3. Presenting College-level courses related to teacher education.
4. Establishing clearer, more commonly accepted, and applicable standards of teaching performance.
5. Conducting basic research into teaching and learning processes.
6. Studying combinations of new media, organized into systematic sequences of instruction, as a means of providing more efficient ways of producing teacher competencies.

Two essential components of the teacher-training process are classroom observation of teachers and children (Conant, 59; Murphy, 187; Sarason, Davidson, and Blatt, 217; Shaplin, 233; Waimon, 266) and the practice - or student teaching experience (Brown and Banich, 36; Byers and Irish, 41; Clothier and Wyatt, 56; Conant, 59; Devor, 70; Hunter, 135; Schueler, 223). Both instructional elements fit well into the theoretical analysis of the teaching function offered in earlier chapters. Observation and practice teaching should contribute to all the teaching skills enumerated in the analysis of the teaching function: the ability to define and analyze teaching goals, knowledge and communication of subject matter, insight into characteristics of child and teacher, and the recognition of environmental influences upon learning.

To what extent can media technology be used in carefully guiding observation and practice teaching experiences? The following two sections describe research evidence which demonstrates the results of using new media in connection with systematic classroom observation and student teaching.

Role of New Media in Proving More Efficient Observation of Classroom Behavior for Teacher Education

A compelling logical argument can be mustered for the use of new media in providing systematic and detailed classroom observation for teacher training. Both closed-circuit television and prepared films have been explored as means of supplying classroom observations in place of student visits to the classroom. Before reviewing research evidence on the role of new media in providing classroom observation, the logical justification for expecting productive results from the use of media will be developed. This theoretical analysis is adapted from Stoller and Less (250) and Stoller, Lesser, and Freedman (251).

Availability of Cooperating Teachers and Schools

The college instructor, using visitation and direct observation in the classroom, must select cooperating teachers and schools within a limited geographic area to minimize travel time between college and school. He may not find teachers who either use precisely the methodology he wishes to exemplify, or provide instruction worthy of observation. The instructor in using either closed-circuit television or prepared films as the observational technique, need not confine himself to the small geographic area used in direct observation.

Availability of Appropriate Classroom Lessons

Correspondence between college and elementary school programs - Using direct classroom visits, the instructor often has difficulty in establishing proper correspondence between the order of topics in his syllabus and the school instructional program. Since the instructor through television can involve a larger number of schools, he is more likely to find teachers whose instructional programs correspond with his course syllabus. The use of films completely eliminates this problem; the film need only be shown at the proper place in the college syllabus.

Lesson planning - Using direct observation, college instructors and public school teachers usually do not have sufficient time in advance of demonstrations to discuss each lesson in every particular. Since television permits simultaneous observation by more than one college class, a number of section of the course may be scheduled at a common meeting time, thus reducing the number of necessary planning sessions. When films are used, lesson planning (both by the teacher alone and by teacher and college instructor jointly) is particularly refined because the lesson is to be recorded only once.

Lesson execution. - Using direct classroom visits, neither the college instructor nor the teacher can predict classroom interaction once the less is in progress. As a result, the college instructor can only orient his students in general to the kind of less to expect, the subject matter, pupil characteristics, and teacher approach. If the lesson moves in an acceptable but unplanned direction, the students view this situation without advance preparation. Even with television, the instructor cannot predict precisely how lesson plans will be executed. However, when prepared films are used, the instructor faces no problem in predicting interaction in a recorded lesson. He previews the film and can tell his tudents precisely what they will and should see. Also, the film can be edited to eliminate undesirable educational as well as technical features. Many more lessons can be recorded than are used, giving the instructor an opportunity to select lessons or lesson segments for final use. In thiswway, a single film can contain segments from lessons taught by a number of teachers in order to compare their instructional techniques.

Availability of a Common Lesson for All College Students

Because of classroom limitations, the use of direct visits divides college classes into two or more groups. Since each group observes in a different school room, it is impossible for the entire class to see the same lesson. Using either television or film, all members of the college class are able to view the same lesson simultaneously.

Role of the College Instructor

Availability of the Instructor. - Because the college class must be divided into small groups for direct observation, the instructor cannot accompany each to its classroom. Therefore, he will not be as effective in elaborating upon instructional procedures not observed in person as he can be when sharing the experience. Simultaneous television or film observation with all of his students, thus eliminates this difficulty.

Instructor as commentator. - During the direct observation itself, the college instructor remains a silent observer. Consequently, he cannot direct the attention of his students, from moment to moment, to what he regards as significant features of the lesson. With television, the instructor need not remain silent. Although the lesson is in progress, he can direct the technical staff to focus their cameras on any aspect of the interaction, reduce the volume of sound so that he can comment on the lesson in progress, and point the attention of students to particular segments of the screen. (This technique is especially valuable when the lesson seems to be moving in unplanned directions.) With film, the instructor has all of these advantages of television, and in addition, he can stop the projector at any point to comment without losing any of the ongoing classroom activity as he would when using television. He can also repeat any portion or all of the entire film.

Student's Field of Vision

When observing in the classroom, the student may focus his attention on any aspect of the entire classroom situation, relevant or irrelevant to the instructor's purposes. The television student is provided with a limited number of television screens, thus restricting his freedom. This restriction, however, may be an asset since the student is provided with selected views of the lesson which should aid him in grasping its essence with greater ease. The film observer has only one view of the lesson. Although this severely restricts his freedom, it also provides the particular focus which the instructor had built into the film.

These comparisons among observational conditions lead to the logical conclusion that films provide a more effective medium of observation than television which is in turn more effective than direct observation in the classroom. How valid is this theoretical analysis of differences among observational methods in their comparative abilities to provide college students with meaningful opportunities to observe classroom teaching and learning? For the most part, current researchiis not sufficiently detailed or precise to reflect upon each separate point in the logical formulation. However, several studies exist which indicate the overall comparative value of direct classroom visits, television, and prepared film as observational devices.

With a few exceptions, the nonsignificant difference is once again the primary finding. Despite compelling theoretical arguments in favor of the advantages of television and film in providing classroom observation, research evidence of their utility is not promising. Rogers (211) and Woodward (280) compared in-person observation (supplemented by various percentages of televised observation), with in-person visitation without additional media observation. Nonsignificant differences in both course achievement and student teaching are reported. Chabe (53) and Rumford (215) also report nonsignificant differences between groups observing by television and those viewing directly in the classroom.

Clemens (55), however, describes an important qualifying condition in these comparisons between television and direct observation, indicating the value of a sequenced combination of observations. This study reports that television observation conducted before in-person observation is significantly more effective than television observation only, in-person observation only, or television observation after in-person observation. The theme of considering the operation of media in combination will be recurrent in the remainder of this research survey.

Mixed evidence also characterizes comparisons between film observation and direct visitation. Painter (198, 199) found that some differences (between film and direct observation groups) which appeared early in the semester, dissolved by the end. Van Horn (264) failed to locate any significant differences between film and direct observation in subject-matter knowledge. Fulton and Rupiper (94, 95) continue the succession of nonsignificant differences between film and direct observation in courses in Human Growth and Development and Educational Evaluation and Guidance, but they succeed in breaking the unrelieved monotony of negative findings by reporting that, in the course in The School in American Cu Culture, film observation (plus slides) was significantly superior to direct classroom visits. Wedberg (270) adds somewhat to this hopeful sign by reporting that two experimental groups (observing in part or entirely by films, sound filmstrips, and slide-tape presentations), showed notably greater gains in a course entitled The Teacher and the School than control subject who observed in the classroom. Wedberg attemuates this encouraging report, however, by further indicating that, judged on an obsolute basis, none of the three groups really gained a great deal from their observational experiences.

Patrick's (200, 201) results provide ground for less-guarded optimism for the prepared film in classroom observation for courses in educational methods. Although an objective test revealed no differences between film and live observation groups, an essay examination showed that the film group gave greater evidence of understanding teaching processes and expressed a more creative approach to classroom observation. More impressive is the fact that students trained by the film method performed significantly better in their student teaching (Patrick, 200) and in their first year of inservice teaching (Patrick, 201), at least in the classroom techniques which had been depicted on the films.

Several studies (Abel, 1; Adolphsen, 4; Gould, 105; Neale, 190; Stoller and Lesser, 250; Stoller, Lesser, and Freedman, 251; Thompson, 257), simultaneously compare all three observational approaches (direct observation, television, and film). Once again the results are not auspicious. Abel (1) reports no differences among the groups in subject-matter knowledge (in a course in Introduction to Secondary Education) or in the ability to apply knowledge to classroom teaching. Neale (190) finds no difference among observational tactics in course examinations or among measures of attitudes toward child behaviors and the teaching profession. Gould (105) reports that the three media of observation were not differentiated for accuracy in the student preception of teacher behavior, and Adolphsen (4) repeated this failure to locate differences in the acuity of student perceptions. Adolphsen (4) reports, however, that no observation combined in developing accurate perceptions of classroom behavior of teachers and children. This finding perhaps is not startling, but this set of University of Minnesota studies (Abel, 1; Adolphsen, 4; Gould, 105; Neale, 190; Thompson, 257) contains an essential element (referred to in chapter 6) which is often missing in media studies, - a "zero" control group which receives no observation at all.

Stoller and Lesser (250) and Stoller, Lesser, and Freedman (251) also simultaneously compare direct observation, television, and film. One measure of student response - an objective multiple-choice measure of information about teaching methods - failed to differentiate the observational conditions. However, another measure - an essay examination assessing ability to critically evaluate an observed classroom lesson - provided strong confirmation of the view that prepared films provide a more effective medium of observation than closed-circuit television, and that television observation is in turn more effective than the traditional procedure of direct visits in the classroom.*

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*A specific finding reported by Stoller and Lesser (250) attests to the crucial role of replication in media research (an issue discussed in chapters 5 and 6). Using the objective test measure of information about teaching methods, significant differences among observational groups were revealed during the first semester of the experiment: television was most effective, direct observation next, and film least. However, during a second semester's replication, the order of effectiveness was reversed, producing a nonsignificant overall result. It is often noted in research on teaching methods that differences among media fade as the innovator's enthusiasm wanes. Replication is perhaps the only real protection against the intrusion of such spurious influences upon experimental results.

In summary, while the overall picture of comparisons among film, television, and direct observation is rather bleak, some promising directions are indicated. Both Patrick (200, 201) and Stoller and Lesser (250) found that vicarious media observation of classroom behavior does not improve objective test scores of gain in subject-matter knowledge but does improve student ability to understand and critically assess an observed lesson as measured in an essay test. Even more provocative are Patrick's reports of the greater long-term gains produced by media observations in direct expressions of teaching ability (both practive teaching and first-year teaching performance).

In addition to these relatively hopeful signs, several suggestions may be offered for increasing both the power of observational experience and sensitivity of the experimental test of these effects. Perhaps the most cogent suggestion is that various observational techniques be studied as supplements, rather than substitutes, for each other. If the different educational objectives served by each medium were specified in detail and verified empirically, optimum combinations of media experiences could be explored.

As one means of increasing the power of classroom observation, Kersh (142, 143, 144) has proposed simulation training procedures which provide a method of exposing students to classroom observation and, in addition, supply a means of inducing active student participation in response to these observations. This media technique may satisfy the most common objection to the value of observation in teacher training - that in conducting any form of observation, the student plays an essentially passive role.

Extensive application of simulation techniques (often using high-speed electronic computers) has been made in military training, industry, and economics. Social science uses of simulation have included the study of a great diversity of phenomena; voter behavior, problem-solving, concept-formation, information-processing, personality development, neurotic processes, diplomatic relations, brain functioning, the development of perception and language, and juvenile delinquency (Borko, 34; Pool and Abelson, 202; Tompkins and Messick, 259). The reasons are not clear for the lack of use of simulation in education - a field to which these techniques should be especially well-suited.

Kersh (142, 143, 144) has, however, introduced simulation into teacher education by adapting motion picture techniques to simulate classroom situations to which the teacher-in-training may react. Multiple projection techniques are described by Kersh to present realistic classroom problems to which the prospective teacher is asked to respond as if she were actually in a classroom. Depending upon the reaction of the observer, a supervisor projects a selected "feedback" sequence" in a short film showing the pupils' predicted response to the observer's reaction. Thus, classroom simulation presents prepared observations on film and, in addition, provides opportunities for the student to respond actively to these observations.

Kersh (143) indicates that the essential components of classroom simulation are; (1) that a suitable (filmed) stimulus situation be presented to the learner; (2) that the physical practive situation be sufficiently realistic to give the learner the experience with some degree of psychological fidelity; (3) that the prospective teacher be required to act out the response just as though in a role-playing situation; and (4) that the feedback provided by supervisor, and the filmed presentation of predicted pupil response, serve to confirm immediately the adequacy of prospective teacher response to an observed classroom situation.

Although Kersh (142) does present some preliminary results of experiments with classroom simulation, evidence regarding its utility in teacher education has not yet accumulated. However, classroom simulation apparently can provide the teacher trainee with planned observational experiences, coordinated opportunities to respond actively to the observation, and immediate information feedback about the adequncy of his response.

Thus, despite sporadic positive results and the emergence of some promising new directions in studies of media as a means of providing classroom observation, the overall appraisal remains discouraging. It is possible, however, that the unimpressive status of these research results lies not in the inadequate power of the media used for observation but in the inadequate sensitivity of experimental tests. Some educators argue that if discernible effects are not discovered, even with relatively gross tests, then the impact of the observational method cannot possibly be great enough to have any real educational utility. On the other hand, even the most powerful teaching methods will be masked or submerged if the experimental appraisal is not precise or inappropriate. Stoller, Lesser, and Freedman (251) have specified some minimal conditions of experimentation which are necessary to provide an experimental test of the relative impacts of several observational conditions; these requisite conditions can be derived from the description of common methodological obstacles in media research presented in chapter 6.

General characteristics of observational conditions

- For all observational conditions, a sufficient number of experiences should be conducted over a sufficient period of time to allow consequences of differential effectiveness of observational techniques to emerge.
- There should be a balanced discussion of observations, focusing upon positive aspects of teacher and child behavior as well as upon deficiencies.
- When films are studied as an observational device, they should be selected from a large pool produced and edited to fit teaching methods of the college instructor and objectives of the college course.
- When any form of media is studied, experimentation should not proceed until technical imperfections and disruptions can be held to an obsolute minimum.

Role of college instructor in observational conditions

- For all observational conditions, the content of the classroom lessons to be observed should be carefully prescribed by the college instructors to fit precisely into identified points in the college course syllabus, the assumption here being that novices in teaching need a structured framework about the nature of the instructional process, both to guide their individual observations and analyses of lessons and to promote effective intra-class communication.
- The observations should be designed by instructors who actually use them in their college teaching. Planning should include as much detailed consultation as possible among college instructors, classroom teachers. and the television production staff.

- College instructors should attempt to maximize the value of each observation by preparing students for the observation and by conducting discussions during the observation and afterwards.
- When films are being studied, the college instructor should plan and direct production of all films in consultation with technical personnel.

Criteria of change resulting from observation

- Dependent variables should be selected which are linked rationally to the capabilities of media used. While numerous claims are made for media as providing a means of observing a great variety of performance skills and information, only those variables which logically are expected to change through exposure to observation should be designated for study.
- Attempts should be made to obtain a broad assessment of the differential effects of observation by measuring not only, for example, informational gains made by the student, but also ability to apply such information to the critical evaluation of classroom behavior, to transfer knowledge in other courses and situations related to the observation, and to gain in actual teaching proficiency.
- These criterion behaviors should be defined operationally and reliable measuring instruments should be constructed to provide an objective appraisal of change.

Experimental design

- Multivariate designs should be used whenever possible to determine not only the influence of main treatment effects (e.g., observational conditions, instructor differences, differences among college students in general scholastic ability, semester differences), but also interactions among these independent variables.
- Random assignment of subjects to experimental conditions should be conducted (or some other adequate system of sampling should be employed), and a substantial sample of subjects should be insured by the use of a sufficient number of sections of the college course.
- Replication should be conducted over several semesters.
- Provision should be made for control of systematic variation of factors (other than the observational condition) which are potentially associated with changes in degree of college learning, e.g., intelligence or general scholastic ability, instructor differences, class size, and skill in responding to examinations irrespective of their content.
- When feasible, pre-post measures of change or covariance control should be used to account for initial differences among teachers-in-training in status on the dependent variables.
- When feasible, "zero" control groups should be used to answer the question of whether any or all of the forms of observation studied are superior to no observation at all.

- When feasible, continuous, ongoing assessment should be conducted over the course of the experiment. Since the effects of observational techniques are expected to be cumulative, an advantage might be gained by observing progressive effects in detail through continuous evaluation.
- Long-term followup should be conducted when possible to study whether differential gains caused by observational conditions are temporary or stable.

Role of New Media in Providing More Efficient Self-instruction and Supervised Practice Experiences

Teacher-training programs have rarely attempted to supply systematic means of providing for individual differences among teacher trainees. General discussions of the need for individualizing teacher training have occurred (Haines, 117), and interesting preliminary efforts to individualize teacher education programs have begun (Binnion et al., 29). However, few teacher-training efforts have either the resources or the necessary acumen to custom-make or modify more than minor aspects of their training procedures to coincide with abilities, needs, and previous experiences of the individual prospective teacher.

> Institutional differences [in teacher education programs] ... are usually attributable to differences inherent in the institutions rather than basic differences in the students. Within certain student teaching programs, there are ways whereby individual differences of student teachers may be accommodated, but these are rarely adequate. "Matching" the student teacher and the supervising teacher is a placement practive which is cited as contributing to an individualized experience, but the rationale and the criteria used from place to place are contradictory. Pace of assuming the teacher role often is conceived as being

variable according to the needs of the individual - but who knows how to identify and relate the manifestations of need to the many alternatives in the student-into-teacher role shift? Commonly, the real problem is that of establishing a "formula" which seems to work out well for most student teachers and then continuing to prescribe it for certain students for whom it may be an altogether unsatisfactory approach. (Ward, 268, p.xi-xii).

It is to remedy this failure to individualize instruction that self-instructional techniques and individualized supervision seem to hold such great promise for teacher education.

Information concerning media use in self-instruction and supervised practice teaching comes primarily from television and film applications, programed instruction, and language laboratories. What have been the teacher-training outcomes of using these devices for self-instruction or supervised practice teaching?

Encouraging results have been obtained in teacher education by using several types of "feedback" techniques (Belanger, 27; Bryan, 38; Gage, 97; Gage, Runkel, and Chatterjee, 99; Flanders, 86). In addition, effective use of television and video-tape film apparently has been made in such closely allied fields as counselor training (Kagan, Krathwohl, and Miller, 139; Landsman and Lane, 148; Walz and Johnston, 267). It is therefore somewhat surprising to find equivocal results for the use of television and film in providing feedback in teacher education.

Schueler, Gold, and Mitzel (224) studied the growth of student-teacher performance under three supervisory conditions. In the control condition, the supervisor observed a student teacher in the classroom, followed by a personal interview as soon thereafter as practicable. In the first experimental condition, the supervisor did not visit a student in person but monitored from the television control room, and reviewed a kinescope recording with the student a few days later. In the second experimental condition, the supervisor visited the class while a kinescope was being made for later simultaneous review by supervisor and student. Changes in student-teacher classroom behavior were assessed for 35 variables such as problem-structuring, maintaining classroom order,ccommand of language, creative and conceptual teaching, introducing and concluding lessons, and individualizing instruction. Although sizeable overall progress in teaching performance was made by student teachers under all supervisory conditions, differences in effects of the three methods of supervisòn on changes in student-teacher behavior were negligible.

Evidence presented by Tintera (258) and Johnson, et al. (138) also displays nonsignificant differences among supervisory media. Tintera compared the effectiveness of three student-teaching critique methods upon both immediate and long-term teaching performance: conventional supervisor observation and conference, supervisor observation and conference supplemented by voice tape recordings made in the classroom, and supervisor observation and conference supplemented by kinescope films of student-teaching performance. Basically, negative results are reported by Tintera, but some suggestion exists that after 6 months of actual teaching experience, teachers trained by film and voice tape recordings show superior performance compared with those who receive only the conventional critique. The Johnson et al. study was focused narrowly upon training teachers to make television presentations, and concentrated upon self-evaluation without supervisory critique. Student-teachers reviewed their own classroom performance by sound film, sound only "program analyzer," and self-evaluation with no outside stimulus. Once again, nonsignificant differences emerge among these self-appraisal devices.

Kersh's (142, 143, 144) classroom simulation efforts are as promising for improving supervised practice experience as they are for observational experiences. Using these techniques, classrooms are simulated through the use of motion picture films and printed materials, and the student practices certain teaching skills hypothetically in response to simulated classroom problems. Immediate concern is with student ability to detect, diagnose, and resolve such teaching problems as confusion, inattention, distraction, and fatigue on the part of the learner. Classroom simulation also provides immediate supervisor feedback to give the student exact knowledge of adequacy of response. Since simulation practices have been applied so recently to education, little empirical evaluation has appeared. Such procedures, however, seem to have a fruitful future in teacher education.

The most commmn self-instructional procedures are, of course, represented by programed courses. Although the many studies (cf., American Association of Colleges for Teacher Education, 11) of applications are still primarily informal in nature, little doubt remains that programed instruction can be applied effectively to teacher competence of knowledge of subject matter. Whether programed instruction also can be of value in contributing to other teacher competencies - the ability to define educational goals, insight into characteristics of children and teachers, and recognition of environmental influences upon learning - is presently undetermined.

Several comprehensive surveys (Fry, Bryan, and Rigney, 93; Lumsdaine, 156; Lumsdaine and Glaser, 157; Schramm, 221; Silberman, 236; Stolurow, 252), describe the evidence for conclusions that, for teaching subject matter, programed instruction usually is superior to conventional procedures, takes less training time than conventional instruction, and is uniformly superior to no instruction at all. Not only does the use of programed instruction result in incrased knowledge of subject matter, but it also apparently reduces variability in student performance (Glaser, Homme, and Evans, 103; Homme and Glaser, 130; Stolurow, 252), although this observation has been questioned (Sechrest and Strowig, 227). Several studies (Ferster and Sapon, 81; Lewis, 150; Oakes, 194) failed to locate significant differences in learning between conventional and programed instruction. However, little doubt reamins that programed instruction can contribute substantially to subject-matter learning by teachers-in-training.

Optimistic proponents find encouragement in programed instruction for the development of teacher competencies other than subject-matter knowledge. For example, McNeil (171, p. 262) states that programing will train teachers to define instructional objectives:

> The programers' practice of defining instructional objectives in behavioral terms forecasts an immediate practical change in curriculum. The pre- and in-service education of teachers increasingly calls for experience in programing, emphasizing the importance of the teacher's being able to specify the behavior of a learner who has reached the objectives of instruction. As one consequence, courses of study and curriculum guides of the future will contain fewer references to vague goals of "appreciation" and "good citizenship." Instead of stating that the learner should be able to understand, say, the meaning of the law of magnetism, the guide will specify the behavior which reveals the learner's understanding of the law, e.g., "be able to write three examples of the law; be able to apply the law in new situations." A wide range of consequences is possible from introducing the operationality of objectives in training programs and materials, and the practice has yet to be evaluated.

Although the promise may exist that programed instruction eventually will contribute to teacher ability to define educational goals, little evidence of this exists at present.

The emphasis in research on programed instruction has not been upon global evaluative comparisons between instructional approaches, but rather upon experimental specification of parameters which determine effectiveness of programed instruction (Carr, 51; Coulson and Silberman, 65; Lumsdaine, 155; Schramm, 221). Parametric studies have examined such factors as the type and logic of sequencing of materials (linear vs. branching); sequence control and pacing (learner vs. machine); size of step, introducing and fading of prompts, practice, review, bypassing, mode of response (recognition vs. answer construction, overt vs. covert); and the type of schedule of reinforcement (immediate vs. delayed). Considerable information is accumulating from these parametric studies, but little application has been made to understand and improve teacher education procedures.

Chapter 3 noted the reliance of programed instruction upon principles of immediate and continuous reinforcement and the progression and pacing of instruction adapted to individual capabilities of the learner. Other principles underlying programed instruction stress active participation by the learner; presentation of programed materials in carefully sequenced small steps, organized in a hierarchic form; the contingency of small unit of response and reinforcement conditions; and the coordination of learning and measurement into a single set of operations. Other principles concern the nature of feedback from learner to programer for use in designing, adapting, and improving programs (Crowder, 66; Fleming 89; Gropper et al., 115; Levonian, 149). In summarizing the operation of these principles, Skinner (238) indicates that the value of programed learning sequences is comparable to that of an effective private tutor: the constant exchange between student and teacher, the insistence that a given point be understood before the student progresses, the presentation of just that material for which the student is ready, and the provision of immediate knowledge concerning the correctness of response (Cohen 57).

No present educational procedure, including programed instruction, is without observable weaknesses. For example, students are reported to complain after completing programed materials that they have difficulty in reconstructing metally the relationships among the main concepts covered; with material presented in very small steps, they have trouble perceiving and retaining the broad context (Coulson, 62). A second reservation derives from an early development in this technology - to offer programed instruction to supplant rather than supplement the teacher. A third reservation stems from the early commercialization of programing; in response to the great commercial pressure to produce programs and machines, inexperienced or inept programers have been used and inordinate claims made for their products. These and other forces have tended to limit the value of programed instruction for teacher education.

Despite these and other reservations, there seems to be sufficient evidence to conclude that programmd instruction focuses attention on the processes by which children learn, it also should be expected to contribute significantly to development of another primary teacher competency - knowledge of student characteristics (Schramm, 221). However, no indication has been received to date that progress in programed instruction has had any bearing on the learning of this teaching skill.

Language laboratories also hold promise of advancing a limited number of subject-matter skills in the teacher education process, although their contribution to other basic teacher competencies appears unlikely. Language laboratories display several counterparts of the properties of programed instruction: all students can practice aloud simultaneously yet individually; differences in learning rates are accommodated; consistent and authentic models of speech are provided; testing of listening comprehension and speaking ability is conducted; and immediate confirmation or correction of student responses can be achieved. Although negative results (Carroll and Sapon, 52) can once again be found, comprehensive reviews (Hayes, 122; Mathiev, 165; Oinas, 195; Van Hooft, 263) leave little doubt aboutthe value of language laboratories in developing foreign language skills in prospective teachers, and in improving these skills in inservice teachers.

In summary, several new media seem suitable for providing more efficient self-instruction and supervised practice experiences, but their utility in teacher education has not been documented by empirical research. It is not clear whether this partial failure is attributable to the insufficient power of instructional techniques or to insensitivity of experimental tests. Once again, progress in improving both power and sensitivity is needed.

Role of New Media as a Direct Means of Presenting College-Level Courses Related to Teacher Education

Research on the use of television and other media to teach college courses redounds with the overall verdict of "no significant differences" between media presentation and conventional classroom presentation. Although these negative results should not be interpreted as authentic proof of the positive benefit of media instruction (cf., chap. 5) the conclusion has been drawn uniformly from these studies that the average college student will learn about as much from, for example, a televised class as from ordinary classroom methods. This predominant negative finding of "non-significant difference" usually has been assigned positive and optimistic meaning - that media do teach just about as well as the usual classroom procedures. A more conservative conclusion is that failure to locate significant differences between media and conventional instruction tells little or nothing about thevvalue of either.

There is clear consensus, however, on the failure of research to distinguish between effectiveness of media instruction and normal classroom techniques in teaching college courses. Schramm (219) summarizes the results of 100 research comparisons of television with conventional classroom learning in colleges. Of this total, 84 studies reported nonsignificant differences, 3 favored television, and 13 found television significantly inferior to classroom instruction.

Schramm's review compares these television research results upon college samples with comparable researchiin the elementary schools, and finds a significantly larger percentage of results favoring television in elementary school studies. Either television instruction has a greater impact at younger ages or the demonstration of learning changes can be located more easily by research at the elementary school level. Studies at the college level also do not indicate any special ability by television to teach any specific subject-matter area more effectively than other areas. Illustrative studies are noted in table 1.

Table 1. - Illustrative studies comparing effectiveness of conventional and media instruction in college courses

Study	Course content	Conditions compared	Findings
Becker and Dallinger (25)	Communication skills	F vs. C	nsd
Burkhart (39)	Literature, government, business	T vs. C	nsd
Carpenter and Greenshill (49, 50)	Chemistry, psychology	TV vs. C	nsd
Deutschmann, Barrow, and McMillan (67, 68)	Engineering	V, TV, C	sd(TV F > C)
Devault, Houston, and Boyd (69)	Mathematics	TV vs. C	nsd
Dreher and Beatty (72)	Psychology, English, creative arts, social science	TV vs. C	nsd
[illegible]y and Mauriello ([illegible], 101)	French	TV vs. C	nsd
Glasgow (104)	Use of media	F vs. C	nsd
Grant and Merrill (106)	Science	TV vs. C	nsd
Husband (136)	Psychology	F, TV, C	sd (F > TV > C)
Johnston (138)	Psychology	AT vs. C	nsd
Klapper (145)	English	TV vs. C	nsd
Macomber and Siegel	Biology, zoology	TV vs. C	nsd
Popham (203, 204)	Educational research	AT vs. C	nsd
Richardson and Diehl (209)	Mathematics, science	F, TV, C	nsd
Seibert (229)	English	TV vs. C	sd(C > TV)

Key

AT .....Audio tape
C.......Conventional instruction
F.......Film
nsd.....Nonsignificant differences
sd(c).....Significant difference favoring conventional instruction
sd(TV)...Significant difference favoring television
T........Telephone
TV.......Television

Study	Course content	Conditions compared	Findings
Seibert (230)	Mathematics	TV vs. C	nsd
Seibert and Honig (231)	Chemistry	TV vs. C	nsd
Snow (243)	Physics	F vs. C	nsd
Stuit et al. (254)	Political science	TV vs. C	nsd
[illegible] et al. (256)	Physics	F vs. C	nsd

Even adding various types of feedback devices does not appear to improve television instruction as a means of direct teaching of college courses. Wolgamuth (1961), for example, failed to find several feedback procedures (which allow communication between students and television instructor) superior to no feedback at all.

Several attempts (Dreher and Beatty, 72; Kumata, 147; Macomber and Siegel, 161; Seibert, 229, 230; Snow, 243; Williams, 275) have been made to go beyond the global nonsignificant differences and analyze personality characteristics and abilities of the learner which may produce differential responses to media and conventional instruction. Most of these studies report negative or equivocal findings, but Snow (243) describes several interesting conclusions. For example, he reports that "...students who are irresponsible or who lack determination perform at a higher level...in conventional learning situations, while instructional films appear to be more appropriate for responsible, persevering individuals." (Snow, 243, p. 116) Or, again:

> "Less emotionally stable individuals tend to retain learned material more adequately if it is originally presented by conventional rather than film means." (Snow, 243, p. 116)

These specific significant results were drawn, however, from such a large total number of comparisons that they may themselves be the result of random fluctuations. Although Snow's results suggest some interesting dimensions of individual difference in responsiveness to various instructional approaches, it would be useful to obtain an analysis of the number of statistically significant results compared with the total number of statistical comparisons performed.

As a direct means of teaching college courses, television instruction appears to fare somewhat better when used for study at home. Of 32 studies reviewed by Schramm (222), 10 reported that at-home television is more effective than ordinary classroom teaching, and an additional 21 displayed nonsignificant differences, the 1 remaining study foavoring ordinary classroom instruction. However, those somewhat more encouraging results are perhaps a function of the unusually high motivation of home-television students reather than of capabilities of the instructional medium itwelf. Few studies have succeeded in controlling motivational differences between home-television students and those taught conventionally.

McKeachie (170, p. 1153-54) summarizes the results of studies such as those reviewed in this section as follows:

> Taking the results of all research on television instruction, we feel safe in concluding that television instruction for a complete course is inferior to classroom lectures in communicating information, developing critical thinking, changing attitudes, and arousing interest in a subject, but that this inferiority is probably not great. This conclusion may surprise the reader who has seen publicity releases reporting no significant differences between classroom and television instruction. In our consideration of methodological issues, we noted the logical fallacy in concluding that no difference exists because the difference found was not great enough to disprove the null hypothesis. This is particularly pertinent here because a review of a number of studies of television leaves one with quite a different conclusion than he might draw from a review of just one. In 20 of the 26 well-controlled experiments reviewed, conventional classes were superior to television classes in achievement. Although few of the differences were statistically significant by themselves, simple application of the sign-test indicates that the differences were not random. In contrast with research comparing other instructional methods, the consistency of results favoring conventional instruction over television is unusual. When one weighs heavily the necessity for accommodating higher education to large numbers of students, however, the differences between television and conventional instruction seem very small. It may be that researchers are reluctant to report findings contrary to the hypotheses of the foundations that support them, and their reports are thus as gentle as possible.

In contrast to McKeachie's logical interpretation the absence of positive results in evaluating media as a direct means of teaching college courses has led to some interesting scientific reasoning. Hoban (124) suggests that every reason exists to expect less learning from television because [illegible] a less [illegible] that [illegible] direct teaching of college courses it is encouraging that it yields even nonsignificant differences when compared with conventional instruction.

Several questions are raised by this line of reasoning. First, if the logical disadvantages of television are so great, is it not foolish to apply or examine an instructional technique which is doomed to inferiority on a priori grounds? Second, can the nonsignificant differences between televised and conventional instruction be regarded as even a partial victory for television? Neither issue allows any real encouragement to be derived from Hoban's argument.

In summary, information regarding the use of media as a direct means of teaching college courses is not encouraging. The most pertinent question remains largely unexplored: Under what conditions, for which students, and in what subject-matter areas do media teach best, and under what conditions is media instruction least effective? On the basis of global appraisals now available, however, only limited potential may be forecast.

Role of New Media in Establishing Clearer, More Commonly Accepted and Applicable Standards of Teacher Performance

Many of Conant's (59) recommendations concerning teacher education have stirred considerable controversy (National Commission on Teacher Education and Professional Standards, 189). One suggestion that has been widely applauded, however, is for establishment of the position of "clinical professor of education." The clinical professor of education would not necessarily be expected to contribute by research and writing, but would be recognized for the quality of his teaching of children and of college students. Among other responsibilities, he would have primary responsibility for the supervision of practice teachers during their induction into classroom teaching. While details of a clinical professor's functions have not been delineated, a necessary requirement is that the goals and standards of clinical supervision be specified fully and precisely.

The value of clinical supervision of teachers-in-training has not yet been demonstrated by empirical research, (Oliver and Shaver, 196). One basic cause of this lack of systematic analysis and appraisal of the supervisory process appears to be the failure of supervisors to obtain consensual agreement concerning goals and strategies of supervision and standards of teaching performance. While general discussions of college supervision of teachers abound (Barber, 22; Shuck, 234), and while a rare document (e.g., Stoller, 249) describes in detail the goals and procedures of an individual college supervisor, few systematic attempts have been made to establish well-defined and commonly accepted objectives and standards among college supervisors. Consequently, a prospective teacher's supervision may emphasize techniques of classroom control, the organization and presentation of subject matter, the projection of a modulated voice, or the proper use of the blackboard - all depending upon the particular college supervisor's priorities or peculiarities. Surely the supervision of different students should emphasize different elements of the teaching process. These emphases, however, should be guided by individual capabilities and needs of the prospective teacher, and should derive only secondarily from individual preferences of the college supervisor. To date, determination of goals and techniques of student teachers has been almost an exclusively private and personal matter. If the "clinical professor of education" is to become a real force in teacher education, some degree of explicit debate and consensual agreement among college supervisors concerning objectives and strategies of student-teaching supervision must be achieved.

The college "clinical professor of education" is only one member of the supervisory team. The "master" classroom teacher ("cooperating," directing," or "supervising" teacher) often is regarded (Hruska, 132; Schueler, Gold, and Mitzel, 224) as having the strongest impact of all upon the prospective teacher. Advice and admonitions have appeared for selecting supervising teachers (Durrance and Garth, 73; Roth, 213; Taylor, 255) and for planning and conducting supervisory sessions (Brown and Banish, 36; Byers and Irish, 41; Chabe, 54; Hunter, 135; Morrison, 184; Sleeper and Telfer, 239; Veselak, 265). But once again, little consensus has been reached (or apparently has ever been attempted) on the definition and delimination of goals and standards of classroom supervision by the master teacher.

Not only college supervisors and cooperating classroom teachers experience problems in establishing a clear and well-accepted consensus of teaching goals and procedures, but the discussion (chapter 6) of problems encountered by researchers in defining and measuring dependent variables in studies of outcomes of teaching methods reflects the extensive history of the debate in establishing definitive research criteria for standards of teaching performance. Within this literature, almost as many proposed taxonomies exist as investigators, and almost as many proposed measurement approaches as taxonomies.

Thus, much remains to be accomplished by college supervisors, classroom coooperating teachers, and researchers in establishing definitions of goals in teaching and in assessing the degree to which these goals are promoted through supervision and other training practices. What seems to be needed by supervisors and researchers in order to work toward adequate definition and measurement of goals of supervision is a situation affording many supervisors and researchers the opportunity to make judgments simultaneously with regard to teacher performance. Using such common observations as are provided by the new media, groups of supervisors and researchers could begin to make the goals of supervision more explicit, build criteria for assessing teacher performance, and construct reliable techniques to measure the degree to which supervision produces change in teacher performance.

Among the many efforts to construct measures of teacher performance (cf., chapter 6) a study by Schueler, Gold, and Mitzel (224) illustrates the potential research use of new media. Using common observations of kinescope films of numerous pratice-teaching sessions, a team of 6 observers was able to contribute substantially to the construction of a reliable, comprehensive, and useful measure of 35 teaching variables, including classroom atmosphere, teacher personality factors, discipline and order, and pedagogical factors such as lesson planning, organization of content, and creative approaches to the teaching assignment. Similar use of common classroom observations provided by the new media has not been made by supervisors in defining explicitly the role, function, and strategies of the "clinical professor or education."

Several dilemmas might be illuminated by the existence of clearer, more commonly accepted definitions and standards of teaching performance. For example, Stern (248) summarizes the evidence indicating that prospective teachers who are strongest by academic standards are least likely to persist in teaching or be viewed favorably by their supervisors on the job. Explicit knowledge of goals and standards used by supervisors would clarify grounds for this and other puzzling results. If the new media can be used effectively to establish more precise, widely accepted, and usable standards of teaching performance for application in supervision and research, teacher training may become less a function of the individual supervisor's or researcher's preferences and priorities, and more rigorous in its execution.

Role of New Media in Conducting Basic Research Into Teaching and Learning Processes Which Underlie Teacher Education

Discouraging empirical results reported in preceding sections of this chapter are derived from studies which rarely use psychological or educational theory in a systematic manner. These studies attempt primarily to locate administrative economies and the immediate instructional yields of the use of new media. Results seem to be little better than chance expectations, and the few positive findings that emerge may easily be artifacts of unspecified characteristics of media condition studied.

Research use of the new media in exploring basic teaching and learning processes has not appeared centrally in studies of the teacher-training process. However, probably the use of new media in education will find its greatest continuing value as a means of generating and testing basic hypotheses about the teaching and learning process. Although little transfer of information has been made to date from basic research to the analysis of teacher education, the new media already have had considerable impact upon fundamental research in teaching and learning processes. For example, the following elements of the instruction process have been studied (Cf., Lumsdaine, 155, 156) through the use of new media:

(a) Conditions for elicitation of active learner response and the role of active participation in learning from sequenced instruction.

(b) Methods for guiding and prompting learner response.

(c) Stimulus-control factors in presentation of instructional materials.

(d) Relative efficiency of visual and auditory modalities in presentation of stimuli.

(e) Operation of knowledge of results, feedback, and reinforcement.

(f) Organization and content of practice, repetition, and review.

(g) Factors of sequencing, rate, and pacing in instruction.

(h) Role of verbalization in learning

(i) Interest, incentive, and motivation in the instructional process.

Miller (179, 180) has presented a careful analysis of basic principles of effective teaching and learning through the use of communication media. This contribution to basic research stresses the operation of fundamental learning variables of drive, cue, response, and reward in using media to study, in part, the following range of issues:

(a) Changing motivation and attitudes.
(b) Developing curiosity and independent judgment.
(c) Establishing better measures of motivation.
(d) Analyzing the role of a teacher in arousing motivation.
(e) Studying how visual cues are perceived, organized, and discriminated.
(f) Establishing parameters in transfer of training.
(g) Focusing attention on relevant cues while maintaining realistic stimulus conditions.
Teaching discrimination of cues.
Representing motion and perceiving movement.
(j) Describing the roles of rehearsing, practicing, and participating in instruction.
(k) Studying the role of labeling in learning.
(l) Analyzing effects of knowledge of progress and results and various types and schedules of reinforcement.
(m) Comparing logical and rote learning.
(n) Organizing instructional materials.

These and other learning and teaching issues generated by Miller's analyses ultimately will have great pertinence to teacher education. To date, little application has been made.

Perhaps an even greater variety of basic research topics on the role of new media in teaching and learning is contained in Arons and May ([illegible]). Topics range from the use of video-tape recording to study effects of delayed visual feedback on task performance (Smith and Smith, 242), the relationship between television viewing and juvenile delinquency (Brodbeck and Jones, 35), the linkage between mass media and interpersonal communication (Back, 19), the use of programed learning techniques to maximaize active participation and feedback in televised instruction (Mitchell, 181), the impact of media upon taste development (Himmelweit, 123), and aggressive behavior (Feshbach, 82) in children.

Only illustrative contributions of the new media to basic research on teaching and learning have been described here. Many other examples exist (Allen, 5; Kumata, 146; Levonian, 149; May and Lumsdaine, 166; Norberg, 193; Schramm, 220; Speisman, et al., 245). The range of basic research questions being studied through the use of new media has been indicated. Very little translation of these basic research findings has been made to teacher education, and little additional basic research apparently is being planned and conducted with such a translation to education in mind. Our basic contention is that the new media will only contribute substantially to teacher education when basic research results begin to illuminate the teaching and learning operations involved in educating teachers. Until basic research on new media is done in the teacher education setting, only limited gains will be realized.

Role of New Media (When Combined Into Systematic Sequences of Instruction) in Providing More Efficient Means of Producing Teaching Competencies

Much of the needed basic research on teaching and learning will not employ a particular medium of instruction singly but will produce various combinations of new media techniques. As the special capabilities and deficiencies of the several new media are identified, combinations of instructional techniques can be devised to maximize unique contributions of each to the analysis and improvement of instruction. This emphasis upon combinations of media in teacher education is compatible with the "systems" concept which stresses the organization among numerous components of any instructional system. Some studies (Carpenter and Greenhill, 50) of the new media in education have elaborated carefully the interrelationships among physical equipment, technical personnel required to operate and maintain this equipment, methods of selecting instructors, acceptance of media instruction by faculty and students, unit costs of media instruction, educational results obtained, and effects of media instruction on the number of faculty members required and released time of faculty members - all of these taken into account simultaneously. In this section, an extension of the "systems" concept is proposed to include possibilities of reciprocal.reinforcement among several new media components of the system. What are the different effects of alternative combinations of media resources upon teacher training?

Examples of attempts to combine systematically several instructional procedures are just beginning to appear in the research literature (Kersh, 142, 143, 144; Morton, 185; Wynn and McKeegan, 282). One illustration (Carpenter and Greenhill, 50; Felbeck, Koen, and Schumacher, 79; Fleming 89; Gropper and Lumsdaine, (110, 111, 112, 113) applies programed instruction principles to development and use of visual media. These efforts emphasize active student response as an important condition for learning as well as systematic efforts to create and present stimuli which would not only produce student response but would also increase the probability that responses made would be those specifically desired. One of the important concepts emerging in an investigation of programed learning is that of introducing branching operations so that, depending upon the subject's performance on given material, subsequent training procedure can be modified appropriately. Applications of principles of programed instruction stress, therefore, the optimal sequencing of media material in an attempt to build into televised or filmed instruction some of the elements of instructional control that characterize programed self-instruction: sequencing of steps in the program, the encouragement of active response by all students to instructional sequences, and the provision of prompt confirmation or reinforcement. This combination of programed instruction principles and televised presentation has produced useful insights for both media.

Another example of a combination of several instructional media is the "computer-based instructional system" or the "computer-based laboratory for automated school systems". (Bitzer and Braunfeld, 3[illegible]; Bushnell, 40; Coulson, 63; Coulson, Bushnell, and Cogswell, 64; Silberman and Coulson, 237). These computer-based systems typically individualize instruction for large numbers of students simultaneously by treating learning as a series of decision tasks. The first is a pretutorial decision sequence that determines the match between student characteristics (e.g., previous information, aptitudes, motivation, personality) and teaching strategies. This is followed by a series of tutorial decisions in which decisions are made by the computer about teaching strategy as it learns progressively more about the student. In these processes, the computer system is both a teaching machine and a learning machine, acting as a control for the whole instructional system. The teacher acts as "orchestrator" of all elements within the system.

Computer-based instructional systems hold promise for investigation not only of the individual learning process, but also of an entire integrated educational system. Interactions among students and between students and teachers can be studied, and conventional methods of instruction can be combined with automated procedures and with media presentations. The effectiveness of different combinations of techniques - including textbooks, instruction by teachers, film and television presentations, programed material, and so forth - would be evaluated. Such data would contribute substantially to modifying entire educational "systems"."

Several other computer applications also may serve to combine various instructional resources. Simulation procedures (Bushnell, 40; Feldman, 80; Kersh, 142, 143, 144), high-speed educational data-processing, information storage and retrieval information analysis and resynthesis can all be implemented by computer techniques and may act as the experimentation or demonstration apparatus for studying combinations of instructional strategies and materials. Little application of any of these computer-based instructional systems has been made in teacher education. Their potential value for teacher education will emerge in clarifying the teaching and learning processes upon which teacher education is based.

Studying media in combination will improve one's knowledge, but will constitute only one step toward the most central and complex issue in the use of new media in teacher education: What can each device and combination of devices do best for different kinds of students, under different educational conditions, with respect to different educational objectives, and when used by different teachers? Obviously, no single medium or combination of media will accomplish the full job of training a teacher. No single criterion or set of criteria for successful teaching is likely to emerge, and no single best pattern for training all teachers is likely to be identified. In the same way, no single best pattern in the use of new media is likely to emerge as most effective under all instructional conditions.

These observations are consistent with the topic discussed in chapter 5 - the inherent complexity of functional characteristics of both the teacher education process and new media. The major problem is to establish the nature of interactions among media used, other teaching methods in which the media are embedded, student and teacher characteristics, conditions of the learning environment, and specified goals of instruction. The use of new media in basic research on complex teaching and learning conditions provides powerful resources for studying and improving teacher education.

course via television vs. one with a "live" instructor in a unversity classroom? A more proper field for experimentation would then be the comparative effectiveness of varying ways of television presentation, course content, and student feedback and of combining all these factors into an optimum teaching approach.

Chapter 8. A Look Ahead

Possibilities for new media in teacher education, have either not been verified through research and experimentation (at least by the kind of research that, by its nature and process, can be considered to be meaningful) or have not yet had sufficient study for proper conclusions and applications to be drawn. It is particularly discouraging to note that most functions of new media which are largely operational in character and therefore capable of the greatest immediate effect on the process of teacher education are those which, though most studied and promoted, remain largely unproved with regard to effectiveness. These are, as analyzed in the previous chapter: (1) providing more efficient observation of classroom behavior for teacher education; (2) providing more efficient self-instruction and supervised practice experiences for teacher education; and (3) presenting college-level courses related to teacher education. Particularly the last remains a monument to the "no significant difference" leitmotiv that infests so much of new media research. And as should now be evident, the authors do not agree with the interpretation that "no difference" is synonymous with "just as good"; it might as well be deemed "just as poor" or more properly as revealing no comparative result. It is suggested, therefore, that a moratorium be declared on further comparative effectiveness studies of complete courses via the new media compared with "conventional" modes of instructio As has been pointed out, the manifold elements embodied in the gestalt of such necessarily global comparisons are not sufficiently isolatable to provide viable conditions for proper research. This is not to say that this function of the new media should be abandoned, but it should not be justified on the basis of comparisons conceived in ways that are basically not researchable. If conditions are sufficiently compelling to justify their use in this function, as, for example, providing instruction to students who could not otherwise be reached, the justificatio should be found in that fact and not in the alleged comparative effectiveness of a

In the case of the first two functions analyzed (observation of classroom behavior, and self-instruction and self-appraisal of practice experiences), the authors believe that, while the bulk of evidence is discouraging, there is so much potential promise in new media possibilities for these functions that more investigation needs to be undertaken, particularly as technological advances bring new media equipment within reach of the average, and not simply the largest and wealthiest, institutions.

A fourth operational function - using combinations of new media organized into systems of instruction - is still largely unexplored. It remains to be seen whether future experiments in such organized multimedia systems will confirm the promise claimed for them. At any rate, the field is open for research and should be pursued. The two closely related functions that fall more nearly into the fundamental research category, with fewer immediate operational implications, significant though their ultimate effect on practice may be, are: (1) establishing clearer, more commonly accepted and applicable standards of teaching performance; and (2) conducting basic research into teaching and learning processes which underlie teacher education. In these functions, the authors see great but as yet largely unproved and unexplored possibilities. It may indeed be that in these areas of fundamental research, rather than in specific operational application, lie the greatest potential contributions of the new media to teacher education.

Finally, a number of generalized considerations are offered as sensitive problem areas that need to be kept in mind when future research and experimentation is undertaken. They offer both the pitfalls to be avoided and principles to be honored.

The Ideal vs. the Possible

Fortunate is the human enterprise that can narrow significantly the gap between should and can, between hope and realization, between the ideal and the possible. Teacher education is no exception. No teacher education institution worthy of its name would fail to respond to the challenge of planning a program unrestricted by limitations of budget, facilities, staff, tradition, institutional and certification requirements, or realities of the job market and school practice, by producing a program radically different from the one it now has and considers to be acceptable within its limitations. If it is a first-rate institution, it seeks to furnish a program that is as close to the ideals it professes as limiting realities will allow. It will accept the limitation of reality as boundaries within which to operate, but will not be intimidated by them, and will consider them to be unfixed; and will be ever alert to possibilities for enlarging the space they confine. Research in new media also must be based on limitations of the possible, particularly in applications to teacher education practice, without being inhibited by them.

At this point, however, a distinction must be made between research designed to effect directly the operational aspects of teacher education (supervision of student teachers via video recordings, for example) and research designed to investigate the nature of phenomena themselves without immediate and primary operational implications - for example, the use of video recordings to analyze the anture of learning and teaching processes. Certainly in the former, the experimentation with immediate operational goals must function within the realm of the possible lest it forfeit all claim to have an operational effect, or at least its vision of the ideal should be within the scope of attainable reality. In the latter, on the other hand, with its goal being investigated into the nature of phenomena themselves, such limitations apply far less; for what is possible in fundamental research should resist any bounds except the limits of the researchers' creative imagination.

Good examples are the several studies made via video recordings with student teachers for the purpose of self-appraisal. Early attempts were made with kinescope film and standard video tape requiring expensive installations far beyond the scope of more than a handful of large institutions, and applicable, because of the logistics and expense involved, even in large institutions, to only a small fraction of the student teaching population. These projects were justified in exploring the contribution of this technique to the process of growth through self-appraisal because portable video recorders of significantly lower cost would soon be made available, bringing their use for this purpose within the realm of practical applicability. Had this not been the case, these studies would have been totally unrealistic in relation to their operational purpose. On the other hand, the same basic technique used to analyze the nature of teaching-learning processes has implications in basic knowledge that are independent of the equipment used as a means for research. Such knowledge will not need a video tape recorder to have its effect, even though the equipment was essential in conducting the research. It is axiomatic, therefore, though often not sufficiently appreciated in much of the new media literature, that research and experimentation with a largely operational focus - that is, fixed on immediate translations into practice - must be posited within a realistic operational framework. On the other hand, research into the nature of teaching-learning behaviors, for example, will not be so limited since its implications are not bound by similar operational restrictions.

The Gap Between Research and Application

The cultural lag between research and application in education is a phenomenon commonly deplored. In the case of the effects of new media research and experimentation upon applications in teacher education, however, this lag is, for a change, to be welcomed. To put it baldly, there is not reason as yet for widespread applications, there being too little to apply. As the three previous chapters have attempted to show, the status of new media research in teacher education is still too uncertain and undefined, and too variable in scope, quality, and function to provide any sound basis for widespread applications in practice, In has not been demonstrated that the new media indeed function in the teaching-learning process to the degree and in the manner claimed.

The first imperative, therefore, is to improve the conception, design, and execution of new media research to the point where any positive conclusions that may emerge can safely provide bases for sound applications. Should this come to pass, however, and assuming that the effectiveness of certain new media applications have been sufficiently demonstrated to justify their widespread adoption, the lag between research and application will in all likelihood persist unless certain additional imperatives are met.

The next imperative is for those engaging in this research to resist actively the occupational predilection to act and write and communicate only with other researchers. This requires more than an exercise in translation from research jargon to commonly communicable English, highly important as this is. (New media research is not exception to the general trend of research in most disciplines to communicate more and more about less and less to fewer and fewer.) Since the primary function of new media research in teacher education is to improve the quality of teacher education, it must, like the new media, be considered to be not an end but a means to an end. Thus, in goal, conception, design, method, communication, implementation, and dissemination, one must consider its function and possible effect on the process of teacher education. The following among many possibilities are offered as promising steps in this direction.

Involving the Practitioner

Chances of achieving the conception, design, and mode of communication most conducive both to conducting effective research and to possible wider implementation in practice, are measurably enhanced by building into new media research and experimentation the very professionals who are expected to benefit by them - the practitioner in teacher education. They, and not the research specialists, will be expected to benefit most from the research. Their active participation on the research team will at least assure that the proper questions are asked in terms of necessary practical applications, and may in fact go far to assure the proper optimum effect in transfer to general as distinct from laboratory applications.

Indeed, it is likely that failure to involve the practitioner early has been a major factor in the generally nonsignificant and inconclusive results of much new media research. Perhaps practitioners might have exercised a restraining influence against premature conclusion drawing and dissemination. No final evaluation, in fact no controlled research, should ever be made before an extensive period of development, involving at the outset much informal, though informed, trial and error. A primary example of this basic fault is the legion of comparative methodology studies which - because of the common fault of prematurely cemented concepts, design, and procedures - were carried on at such a low overall level of efficiency that in many cases there seemed to have been little point in conducting the research at all. The wise, informed practitioner, as a member of the research team, might help in maintaining the needed practical perspective.

Designing for Inter-Institutional Involvement

A distressingly large amount of new media research activity is provincial in character, beginning and ending within the institution that gave it its home. As a result, its scope, significance, and possible effect are limited to the one institution (where it often has little affect except to provide the basis for more research and for professional advancement of the researcher), and the intimate circle of the professional association where it is reported to other members of the inner circle similarly engaged in projects of equally limited scope and effectiveness. As shown in previous chapters, the need for replication on the one hand, and decrease in wasteful duplication based on ignorance of what is happening elsewhere on the other, is a paramount need in new media research. Designing experimentation at the outset, in cooperation with other institutions, may effectively set the stage for necessary replications, wider applications, and more variegated scope and design.

Providing for Informational and Evaluative Lines of Communication in New Media Research and Experimentation

While one may bemoan the lack of replication in much new media research, considerable evidence exists that studies are undertaken without knowledge of a similar research completed elsewhere. Duplication, particularly that undertaken in ignorance of what has gone before, is not replication. While there are many dissemination media of new media research, they evidently are not sufficiently effective in avoiding wasteful duplication. Whether this is the fault of dissemination media or of nonscholarly researchers is perhaps less important a consideration than that the condition does exist. Particularly important, in the case of new media affecting teacher education, is the necessity for bringing to institutions and personnel involved in teacher education accurate, comprehensive, and evaluative information regarding ongoing research and experimentation, and for sensitizing the personnel of such institutions to such information.

Media as Media, Not as Ends

The basic plan for this review is a reflection of the authors' conviction that goals in teacher education should determine programs and means. Therefore, the study began with a suggested formulation of outcomes based on an analysis of the teaching function. It then posited certain functional characteristics of new media, speculated as to their possible contributions to the attainment of teacher education outcomes, and finally analyzed in some detail the nature of media research and its present status in providing evidence of the use and effectiveness of these media in contributing to outcomes of teacher education. While it may seem gratuitous and self-evident to belabor the point, it is important to stress at this time that the new media must be considered primarily as media, as means, as instruments, just as books, test-tubes, classroom buildings, and indeed professors and instruments that derive their primary justification from the functional contribution they can make to outcomes of education. Unfortunately, progress in the evaluation and considered use of new media is to some degrees inhibited by the distraction of promotional techniques more appropriate to advertising than to education, which imply justifications that seek to elevate new media to the status of ends in themselves. This problem is not new; it arose with "old" as with "new" media (as anyone who has tried to convince a textbook publisher's representative of the desirability of a reading list over a prescribed text can attest), but it is particularly potent with the newer media. It is imperative, therefore, that considerations for research, evaluations, and use of the new media be based on their function in contributing to outcomes of teacher education and not to a justification of their use per se. The primary question is not how much use can be made of films, television, and programed instruction in teacher education, but how can the functional outcomes of teacher education be furthered by these new media? As this study has shown, much needs to be done in specifying outcomes and [illegible] the new media to their attainment. Great promise may lie ahead, but only a relatively small portion of research now available provides clues for proper future directions.

Few social problems, however, are as important as the effective training of teachers. While finding proper future directions in improving teacher training may be difficult, the potential gain is almost without boundary. The extent to which new media may help in this improvement still is largely undetermined, but it is hoped that this analysis of the process of teacher education and the nature of media research has suggested promising directions to pursue.